

U.S. DEPARTMENT OF ENERGY  
RICHLAND OPERATIONS OFFICE

B-680H-C1  
REVISION 0

CONSTRUCTION SPECIFICATIONS

FOR

PFP LIQUID LOW LEVEL WASTE SYSTEM MODIFICATION

HANFORD, WASHINGTON

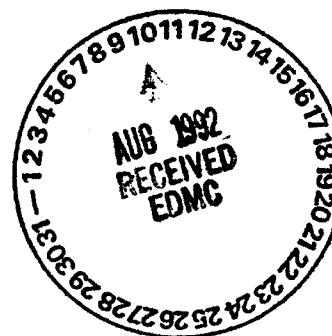
FOR

WESTINGHOUSE HANFORD COMPANY

BY

KAISER ENGINEERS HANFORD COMPANY

APRIL 17, 1992



B-680H-C1  
Revision 0

CONSTRUCTION SPECIFICATION FOR

PROJECT B-680H  
PFP LIQUID LOW LEVEL WASTE SYSTEM MODIFICATION  
WASTE TREATMENT FACILITY

Work Order CR9280

Prepared By:  
Kaiser Engineers Hanford Company  
Richland, Washington

For the U.S. Department of Energy

Contract DE-AC06-87RL10900

APPROVED  
TCF Kaiser Engineers, Inc.

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Projects Department	Date

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## SECTION 01010

### SUMMARY OF WORK

#### PART 1 - GENERAL

##### 1.1 INTRODUCTION

1.1.1 The construction of the Low Level Waste Treatment Facility (Building 243 - Z and 243 - ZA) and its support systems are a portion of the scope for Project B-680H, "PFP Liquid Low Level Waste System Modifications". The new facility will be located inside the Plutonium Finishing Plant (PFP) protected area. The PFP protected area is within the 200 West Limited Area. The 200 West Limited area is within the Controlled Access Area of the Hanford Site. The PFP is approximately 33 road miles northwest of Richland, Washington. The "Operating Contractor" is Westinghouse Hanford Company (WHC). Kaiser Engineers Hanford is referred to as KEH.

##### 1.2 STATEMENT OF WORK

1.2.1 Scope: Work consists of furnishing labor, equipment, and materials to provide an operating facility in accordance with the Contract Documents.

1.2.2 Work Included: The following itemization is intended to identify major work elements and to be broad in scope. It is not all inclusive.

- 1.2.2.1 A. Earthwork
  - 1. Finish to grade
  - 2. Backfill
- B. Asphaltic Concrete Paving
- C. Foundations for the building, HVAC Stack, and Effluent Retention Tanks
- D. Pre-engineered building
  - 1. Custom Casework
  - 2. Thermal and Moisture Protection
  - 3. Doors and Frames
  - 4. Finishes
- E. Heating, Ventilation, and Air Conditioning (HVAC)
- F. Fluid Waste Treatment and Disposal equipment
- G. Instrumentation and Controls
  - 1. Effluent Treatment and Processing system
  - 2. HVAC system
- H. Fire Protection
  - 1. Sprinkler system
  - 2. Riser

- I. Plumbing
- J. Electrical
  - 1. Service and Distribution
  - 2. Alarm and Detection System
  - 3. Utilities
  - 4. Process
- K. Piping systems, except as noted in 1.2.3.
  - 1. Air, Water, and Drains
  - 2. Process
- L. Tanks and Tank Storage Area

1.2.3 Work Not Included: Following work elements are part of Project B-680H but will be covered by others through their documents. This work will be accomplished concurrently with work included in this Contract Document.

1.2.3.1 Items shown on the drawings to be performed or supplied by WHC KEH, and/or government.

1.2.3.2 The following items will be provided (by others) to the structures or within five (5) feet of the structures, as indicated on drawings.

1.2.3.2.1 Fire water main and Electrical Conduit for Post-Indicator Valve.

1.2.3.2.2 Electric power line and tie-in to building 243-Z.

1.2.3.2.3 Sanitary water main and tie-in to building 243-Z.

1.2.3.2.4 Compressed air piping and tie-in to building 243-Z. (Note: The service air pressure is between 67-93 psig and will be reduced to 10 psig in building 243-Z.)

1.2.3.2.5 Influent sewer piping 5' out from Manhole 5 and pipe to pipe tie-in to manhole.

1.2.3.2.6 Effluent sewer piping 5' out from Manhole 6 and pipe to pipe tie-in to manhole.

1.2.3.2.7 Electrical conduit up to the 234-Z building.

1.2.3.2.8 Excavation below grade for the fire water main, electrical power, and sanitary water.

### 1.3 DRAWINGS

1.3.1 Drawings which show work to be accomplished by the Contract Documents are listed on drawing H-2-82708, "TITLE SHEET PFP LLWTF DWG. LIST AND VICINITY MAP".

END OF SECTION

## SECTION 01019

### ITEMS FURNISHED FOR CONSTRUCTION

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 Code of Federal Regulations (CFR)

Title 30

Mineral Resources

Part 56

Safety and Health Standards--  
Surface Metal Nonmetal Mines

##### 1.2 SUBMITTALS: Not Used

##### 1.3 GENERAL

1.3.1 Material and equipment furnished or made available for incorporation into the Work are identified in this Section. Other services and utilities provided are covered in other sections of this Specification.

1.3.2 Meet the provisions of Section 9 of the Contract General Conditions for items furnished for construction.

1.3.3 Provide KEH access to premises where items furnished for construction are stored before incorporation into the Work.

##### 1.4 GRAVEL AND SAND

1.4.1 Unmined natural deposits are available at no cost from sites designated by KEH within 20 miles of Project site. KEH makes no representation that materials will meet physical properties required in this Specification.

1.4.2 If Contractor elects to utilize available gravel sites he shall furnish equipment and labor required to excavate, process, load, transport, and place material.

1.4.3 Material shall be used only for the Work covered by this Specification and no gravel or sand, processed or unprocessed, or concrete manufactured therefrom shall be transported off the Hanford Site.

1.4.4 Access to gravel sites and travel between gravel and construction sites shall be on roads designated by KEH and use shall be in accordance with Section 01500.

1.4.5 Operations of gravel sites shall meet the following requirements.

1.4.5.1 Confine removal of overburden and top soil to areas designated by KEH. Stabilize blow sand areas after surface has been disturbed, with ballast or other approved method to prevent wind erosion.

1.4.5.2 Make no excavation or bank cut within 100 feet of power lines, paved roads, railroads, security fences, or other permanent structures.

1.4.5.3 Excavating and processing shall be in accordance with 30CFR56. Correct operations identified by KEH to be hazardous to life or property.

1.4.5.4 Explosives are prohibited articles described in Section 56 of the Contract General Conditions and shall not be brought to the Hanford Site or proposed for use without written KEH approval.

1.4.5.5 Temporary structures are permitted at gravel site for offices, storage, or repair facilities necessary for gravel removal and processing. No facility for habitation will be permitted.

1.4.5.6 Use of gravel sites are nonexclusive. Others may also enter to excavate material required for other work.

1.4.5.7 Upon completion of operations clear gravel site of debris, temporary structures, and equipment. Grade excavated area, properly slope banks, and stabilize to prevent wind erosion. Conditions identified by KEH as not meeting these requirements shall be corrected before final acceptance of the Work.

1.4.5.8 Right to use gravel sites may be terminated by KEH for failure to meet the requirements set forth or for abandonment of operations under this Contract. Right to use gravel will terminate without notice upon acceptance of Work under this Contract.

## 1.5 MATERIAL AND EQUIPMENT

1.5.1 Items listed below will be furnished by WHC for incorporation into the Work.

1.5.1.1 Remote Control Module (instrumentation and control system)

1.5.1.2 HVAC:

1.5.1.2.1 HEPA filters, 24" x 24" x 12", 99.97% Efficiency

1.5.1.2.2 Prefilters, 24" x 24" x 2", 30% Efficiency

1.5.2 Items noted in subparagraph(s) 1.5.1.1 & 1.5.1.2 are on hand and presently stored by WHC. Notify KEH 5 working days before need date to arrange for delivery.

1.5.3 Furnish other items, shown on the Drawings or specified, required to complete the Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

# SECTION 01027

## APPLICATIONS FOR PAYMENT

### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FORMAT

1.3.1 Complete Form KEH-1026.00, Progress Estimate Backup (Form KEH-0960.00, Backup Sheet for Unit Price Contract), sample appended. Contractor developed substitute for form may be used with prior approval of KEH.

1.3.2 Complete Form KEH-0959.00, Monthly Estimate of Work Completed, sample appended, or include following in letter requesting payment.

Subtotal Value of All Pay Items	\$X,XXX.XX
Completed to date (Include modifications)	

Allowance for Material Stored on Site:

Previous Net Allowance	\$X,XXX.XX	
Minus Materials Placed	\$X,XXX.XX	
Plus Materials Stored	<u>\$X,XXX.XX</u>	
Net Allowance		<u>\$X,XXX.XX</u>

Subtotal Value Completed to Date		\$X,XXX.XX
Less Previous Payments	\$X,XXX.XX	
Less Other Charges from KEH	<u>\$X,XXX.XX</u>	
Subtotal Deductions		<u>\$X,XXX.XX</u>

Total Payment Requested	\$X,XXX.XX
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Less Retainage at ____%	<u>\$X,XXX.XX</u>
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Total Payment Allowed	\$X,XXX.XX
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### 1.4 APPLICATION PROCEDURE

1.4.1 Payments to Contractor specified in Section 15 of Contract General Conditions are initiated by Contractor making application as follows.

1.4.1.1 Begin application by completing Form KEH-1026.00. For lump sum contracts, each application shall include, as minimum, breakdown of Contract price for items listed in Section 01310 and percent complete for each item.

1.4.1.2 Review backup sheets with KEH approximately 5 days before end of pay period, end of pay period shall be the last Sunday of each and every month, and adjust data if required by KEH.

1.4.1.3 Finalize application by meeting requirements of Paragraph 1.3.2.

1.5 PAYMENT PROCEDURE

1.5.1 Upon receipt of application, KEH will audit data and check for compliance with requirements of Section 01720. When satisfied that Contract requirements are up-to-date, Form KEH-0959.00 will be signed by KEH.

1.5.2 Copy of signed Form KEH-0959.00 showing amount of payment to be made will be furnished to Contractor.

1.5.3 KEH will mail check to Contractor's designated address.

1.6 ADDITIONAL DATA REQUIRED

1.6.1 When processing applications for payment and preparing payment documents, KEH may require data to substantiate and justify amounts requested. Processing of payment documents may be delayed if data is not forwarded expeditiously to KEH.

1.6.2 Requests for payment for equipment or material which Contractor has received, but has not installed, shall be accompanied by invoice or other data to provide evidence that title to equipment or material is held by Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used



## PROGRESS ESTIMATE BACKUP

Sheet      of

[illegible]

**KAISER ENGINEERS  
HANFORD****MONTHLY ESTIMATE OF WORK COMPLETED**

Contract or P.O. No.		Estimate No.		Date	
Name of Contractor					
Address					
Nature of Work					
Initial Amount of Contract \$		Total Amount of Modifications to Date \$		Total Adjusted Contract Amount \$	
Description				Amount	
Estimated Work Completed to (Date)					
Less: Previous Payments		\$			
Other Charges (Explain Below)		\$			
Total Deductions				(\$	)
Adjusted Payment Requested				\$	
Less Retainage @ _____%				\$	
Total Payment Allowed				\$	

I certify that I have verified this periodical estimate dated \_\_\_\_\_ for \$ \_\_\_\_\_ and that to the best of my knowledge and belief it is a true and correct statement of work performed and that the contractor's statement of his account and amount due him is correct and just, and the quantities included in this estimate have been performed in full accordance with the terms and conditions of the corresponding construction documents.

FOR THE CONTRACTOR

KAISER ENGINEERS HANFORD COMPANY

By \_\_\_\_\_  
Project Manager

By \_\_\_\_\_

By \_\_\_\_\_  
Field Contract Engineer

## SECTION 01040

### COORDINATION

#### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

#### 1.3 CONSTRUCTION ACTIVITIES

1.3.1 Coordinate construction activities to ensure efficient and orderly sequence of work, with provisions for accommodating items to be installed later.

1.3.2 As noted in Section 29 of the Contract General Conditions, other contracts may be under construction concurrently with the Work included in this Specification. Coordinate activities with other contractors for mutual benefit. Coordination meetings may be required in addition to progress meetings to keep parties informed of scheduled activities at interface points.

1.3.3 Certain onsite work related to the Project will be performed by KEH. Cooperate and coordinate work to eliminate interferences and delays.

1.3.4 A Health Physics Technologist (HPT) for Radiation Protection is required for all excavation. A HPT is available between the hours of 8:00 AM to 11:30 AM and 12:45 PM to 3:00 PM. Exceptions to this are Wednesdays and every 2nd Tuesday of the month an HPT will not be available until 12:45 PM.

1.3.5 Removal of contaminated soil will be responsibility of KEH. Assistance may be required during removal to expedite work and minimize downtime.

#### 1.4 WORK IN EXISTING FACILITIES

1.4.1 All buildings identified in drawing H-2-82711, CIVIL PFP LLWTF PARTIAL SITE PLAN, are operating facilities and work shall be planned and scheduled to prevent interference with plant operations and sustain safety of operating personnel.

1.4.2 Access to work area will be as directed by KEH to minimize disruptions to work force.

1.4.3 Keep work area safe and orderly for construction and operating personnel. Clean work area after each work period and stack tools and materials away from traffic areas.

1.4.4 Plan for 1/4 hour per person per day to use a hand and foot radiation counter. All personnel must use the counter before exiting the PFP protected area.

#### 1.5 CONNECTIONS TO EXISTING SYSTEMS

1.5.1 Advance notice of work that will affect existing systems shall be given to KEH. Careful planning and scheduling of work is required to coordinate operations of existing systems to keep disruptions at minimum.

1.5.2 As required in subsection 50.8 of the Contract General Conditions, connections to existing systems shall be scheduled well in advance for work to be done. KEH will coordinate schedule with Contractor and system operators.

1.5.3 Connection shall be accomplished within 8 hours.

#### 1.6 ACCESS TO WORK AFTER POSSESSION

1.6.1 Access to warranty work as specified in Section 24 of the Contract General Conditions or access to work after possession as specified in Section 20 of the Contract General Conditions will be coordinated by KEH with other contractors, and users of facility. Notify KEH in advance of proposed work to minimize disruptions.

#### PART 2 - PRODUCTS

Not Used

#### PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 01043

### JOB SITE ADMINISTRATION

#### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

#### 1.3 WORKING HOURS

1.3.1 Regular day shift working hours are from 7:30 am to 4:00 pm, Monday through Friday, excluding holidays.

1.3.2 For other than regular day shift work refer to Section 51 of Contract General Conditions.

#### 1.4 BADGE, DOSIMETER, AND ORIENTATION

1.4.1 For work within the Controlled Access Area and inside Limited and Protected Areas, badge, basic dosimeter, and orientation requirements will be in accordance with Section 56 of Contract General Conditions, and Special Entrance Authorization (SEA) badges are required, and will be furnished by the Operating Contractor (WHC) at request of KEH. Contractor is responsible to initiate the monthly renewal of SEAs.

1.4.1.1 Work Authority Badges are sufficient inside Property Protection Areas, and Security Escorts are not required.

1.4.2 Badges will not be provided until notice to proceed letter has been signed and returned to KEH, supervisors have attended KEH safety training course, requirements of Section 55 of Contract General Conditions have been received and approved by KEH, and site labor conference and preconstruction meeting specified in Section 01200 have been completed. Initial issuance of SEA badges requires 24 hour notice.

1.4.3 Contractor personnel will be required to log-in and log-out on a daily basis. Log book is located in the main lobby of 234-5Z building.

#### 1.5 EMERGENCY RESPONSE DRILLS

1.5.1 Personnel working on Hanford Site shall participate in emergency response drills held approximately once each calendar quarter and lasting approximately one hour.

1.5.2 Maintain daily log or other suitable record of personnel names, including subcontractors, working on Hanford Site.

#### 1.6 SECURITY

1.6.1 General: Contractor employees shall comply with Section 56 and 87 of Contract General Conditions. Copies of KEH security procedures will be provided upon request after contract award.

## 1.6.2 Security Escorts

1.6.2.1 Security Escorts are required for following. Personnel include all employees of the Contractor, his subcontractors, and lower tier companies.

- a. Personnel working within 100, 200-east, 200-west, 300, and 400 Limited Areas if they do not have an unescorted security badge.
- b. Personnel working within Protected Areas.

### 1.6.2.2 Provide following:

- a. List of employees. List of vehicle operators and their driver's license numbers. List of vehicles, backhoes, and trailers with the make, model, license numbers, and registration numbers identified. Submit lists 2 weeks before start of work in Protected Area and anticipated start and duration of the utilization.
- d. Weekly work schedule of employees for escort requirement determination. Submit schedule no later than Thursday of week preceding escort requirement (minimum 24 hour notice required for changes).

1.6.2.3 Escorts will be assigned from the following escort trailer. Meet and transport personnel and escorts at/from this location. Parking for personnel and contractor vehicles is available at escort trailer.

- a. Work in 200 West Area: KEH trailer outside 200-East Limited Area near Access Gate No. 814. Located 5 miles east of 200-West Limited.

1.6.2.4 The ratio of escorts to uncleared Contractor personnel for the purpose of daily transportation of men and materials to the worksite shall be 1 to 5, irrespective of the type of craft or lower tier companies the 5 personnel represent.

1.6.2.5 The ratio of escorts to uncleared personnel at the worksite through the course of a workday shall be the same as set forth in subparagraph 1.6.2.4.

1.6.2.6 Contractor shall provide "pooled" transportation for his uncleared personnel and the KEH escorts into the limited/protected work areas. A maximum of 3 Contractor vehicles for uncleared personnel will be allowed into the limited/protected area at any time. No personal vehicles will be allowed into the limited area under this contract.

1.6.2.7 Parking for personnel and Contractor vehicles not used due to "pooling" of personnel to the worksite shall be available at the escort trailer near 200 East Area Gate 814.

1.6.2.8 Escorts are provided at no cost, except that a charge of \$22.00 per hour may be assessed for each escort if personnel do not arrive at the scheduled time and place.

### 1.6.3 Unescorted Access

1.6.3.1 KEH may authorize unescorted access to Limited Area for personnel meeting following requirements.

- a. Full time employment with expectation of full employment for contract duration.
- b. Pass employment suitability investigation by KEH.

1.6.3.2 Application forms will be furnished by KEH upon request. Anticipate 4 weeks for investigation process.

### 1.6.4 Prohibited Article Property Pass

1.6.4.1 Prohibited Articles require a property pass to be brought onto the Controlled Access Area of the Hanford Site. KEH will request property passes for Contractor's articles from WHC Property Management. Prohibited Articles include cellular telephones, tools and implements that may be considered as a weapon (ie. axe, hatchet, knife blades > 4" in length), and other items.

## 1.7 WORK ON OR NEAR ELECTRICAL LINES OR UTILITY POLES

1.7.1 In addition to requirements of subsection 50.2 of the Contract General Conditions, whenever work is performed under, adjacent to, or on overhead electrical lines or utility poles, notify KEH at least 3 working days before work commences. Notification shall include names and qualifications of personnel performing work, and the methods and equipment that will be used. KEH will coordinate with the Site Utility Organization and notify the Contractor of special safety or operational requirements.

1.7.2 Some work will require that standby lineman be in attendance. Lineman will be furnished by KEH.

## 1.8 SAFETY REQUIREMENTS

### 1.8.1 Fire Safety

1.8.1.1 Address fire safety as part of construction safety plan required by Section 55 of the Contract General Conditions. Incorporate following requirements into plan.

- a. Utilizing portable shields wherever welding, cutting, or grinding.
- b. Maintaining fire watch minimum 1/2 hour after welding, cutting, or grinding.
- c. Having fully charged fire extinguisher available whenever welding, cutting, or grinding.
- d. Method to prevent ignition of brush fires.

1.8.1.2 See Section 01500 for off-road driving and grass fire prevention requirements.

## 1.8.2 Safety Apparel

1.8.2.1 Personnel shall wear appropriate foot wear, hardhats, clothing, and approved eye protection in recognized construction area or while on business at KEH shops or yards. Tennis shoes, canvas type shoes, open toe shoes, sleeveless shirts, and cutoff pants do not meet this requirement.

## 1.8.3 Materials Containing Asbestos

1.8.3.1 It is not anticipated that Contractor will encounter materials containing asbestos. However, asbestos which is not readily identifiable may be present in some materials in and around work area. Examples include:

- a. Floor tile.
- b. Floor tile adhesive.
- c. Transite siding.
- d. Transite pipe.
- e. Roofing shingles/matting.
- f. Electrical insulation.
- g. Gasket materials.

1.8.3.2 Material suspected of containing asbestos shall not be disturbed. Contact KEH for direction before proceeding with work which would disturb material.

1.8.4 Core Drilling: Equip core drill with kill switch to stop drill upon hitting metal. Demonstrate that switch is operational before drilling.

1.8.5 Job safety analysis required in subsection 55.2 of the Contract General Conditions shall address following work items as minimum.

1.8.5.1 Excavations.

1.8.5.2 Scaffolds.

1.8.5.3 Hazardous materials.

1.8.5.4 Lockout and tagout procedures.

1.8.5.5 Shoring.

1.8.5.6 Welding or cutting.

1.8.5.7 Confined spaces.

1.8.5.8 Paint/coatings.



1.8.6 Current Material Safety Data Sheet for each hazardous material must be kept at the job site.

1.8.7 A 48" woven personnel barrier is required to surround the construction area. Barrier is supplied by the Contractor.

1.8.8 Supply air monitoring devices for confined spaces.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01050  
FIELD ENGINEERING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 QUALITY CONTROL

1.3.1 Establishing alignment, support location, and grades shall be the responsibility of a Land Surveyor registered in the State of Washington and acceptable to KEH.

1.3.2 Deliver field notes, records, and documentation to KEH to review and verify procedures used and accuracy of work.

1.4 SURVEY DATA

1.4.1 Basic reference points with coordinate descriptions and bench mark with elevation identified will be located on Drawing H-2-82711, "CIVIL PFP LLWTF PARTIAL SITE PLAN".

1.4.2 Preserve bench marks and reference points, including stakes or other markers established until removal is authorized by KEH.

1.4.3 From information and dimensions shown on the Drawings, perform survey/layout required by the Work.

1.5 PROCEDURES

1.5.1 Before initial layout, field verify horizontal and vertical data. Report discrepancies to KEH before proceeding.

1.5.2 Establish adequate permanent reference points to be used during construction, referenced to original control points. Record locations with horizontal and vertical data on Project record documents.

1.5.3 Protect and preserve control and reference points until Work is complete. Report loss or destruction of control points to KEH. Report relocation or change in data affecting reference points.

1.5.4 Periodically verify data for control and reference points, and construction stakes to maintain construction accuracy.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 01065

### PERMITS

#### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FEDERAL, STATE, AND MUNICIPAL LAWS, CODES, AND REGULATIONS

1.3.1 Required permits or licenses to do business are responsibility of Contractor as specified in Section 6 of the Contract General Conditions.

#### 1.4 HANFORD SITE PERMITS

1.4.1 General: Before certain types of work can be done at Hanford, Contractor is required to have a permit. Permits are provided by KEH at no cost, however, furnish information required and notify KEH in advance of work requiring permit. Meet the requirements and restrictions set forth in each permit. Keep permits posted in visible location at site of work being performed.

1.4.2 Excavation Permit: Do not excavate without the permit specified in subsection 50.10 of the Contract General Conditions. Permit will be issued before start of construction and is for duration of the Work. Only flat faced buckets on backhoes will be allowed.

1.4.3 Backfill Permit: Each element of fill and backfill requires a permit. Permits are good for 5 days, or duration of work element provided Work does not stop for 5 consecutive days. Complete permit form, furnished by KEH, and return to KEH for approval before starting work.

1.4.4 Tie-in Permit: Each utility tie-in requires a permit. Permits are valid until tie-in is complete. Permits furnished by KEH with 5 days notice.

1.4.5 Hazardous Work Permit: Start no work without permit. Permit will provide personnel protection requirements and restrictions for work involving welding and cutting, confined spaces, hazardous materials, or other hazardous working conditions. Permit is good for duration of Contract. Initiation of hazardous work permit is responsibility of the Contractor.

1.4.6 A daily Work Authorization Form (WAAF) must be filled out and submitted by the Contractor by 3:00 PM to the PFP Operations Shift Office located in building 234-5Z. Work not listed on the WAAF will not be allowed, listing of more work than shall be completed is permissible. The WAAF is used for plant coordination and for emergency responses. For emergencies, the supervisor in charge and the number of workmen need to be accounted for. The KAISER WAAF FORM is appended to this section.

1.4.7      Oversize Load Permit: In addition to Washington State permit, obtain permits for each movement of each oversize vehicle or load within the Hanford Site. Permits will be furnished by KEH with 48 hour notice of width, height, and length of oversized load and proposed route of travel. Verify proposed route has been traveled and limitations have been identified. See Section 01500 for additional requirements.

1.4.8      Solid Waste Disposal Permit: See Section 01500, Paragraph 1.3.3. This permit is required for disposal of nonhazardous waste on the Hanford Site. Obtain form from KEH, complete, and return to KEH for approval before moving waste to the disposal site. Contractor is responsible for obtaining permit and signatures.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

# KAISER WAAF FORM

Date	Shift	Bldg.	Name of Work Superintendent	Job Number
------	-------	-------	-----------------------------	------------

Job Description

## CRAFT SUPPORT REQUIRED

Boilermakers <input type="checkbox"/>	Electricians <input type="checkbox"/>	Laborers <input type="checkbox"/>	Operators <input type="checkbox"/>	Sheetmetal <input type="checkbox"/>	Other _____ <input type="checkbox"/>
Carpenters <input type="checkbox"/>	Insulators <input type="checkbox"/>	Machinists <input type="checkbox"/>	Painters <input type="checkbox"/>	Sprinklerfitters <input type="checkbox"/>	_____ <input type="checkbox"/>
Cement Masons <input type="checkbox"/>	Ironworkers <input type="checkbox"/>	Millwrights <input type="checkbox"/>	Pipefitters <input type="checkbox"/>	Teamsters <input type="checkbox"/>	_____ <input type="checkbox"/>

Yes    No

<input type="checkbox"/>	<input type="checkbox"/>	Cutting, Welding, Grinding or Other Contamination Potential
<input type="checkbox"/>	<input type="checkbox"/>	Radioactive Coolant System to be Opened
<input type="checkbox"/>	<input type="checkbox"/>	Asbestos Removal

## APPROVAL TO START WORK

RM Supervisor	Time	Date	RWP Number
---------------	------	------	------------

Special Requirements for Entry RM Supervisor

## SPECIAL REQUIREMENTS FOR WORK APPROVAL SHIFT MANAGER

Class Level	Lockout Number	Shift Manager	Time	Date
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Shift Manager Entry

End of Shift Status (Provide to Operations One Hour Prior to Shift Change)

End of Shift Cleanup Completed Yes <input type="checkbox"/> No <input type="checkbox"/>	Lockout Removed Yes <input type="checkbox"/> No <input type="checkbox"/>	Shift Manager End of Shift
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## SECTION 01100

### SPECIAL PROJECT PROCEDURES

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications including documents referenced therein, form part of this Section to extent designated herein.

###### 1.1.1.1 Code of Federal Regulations (CFR)

Title 29

Labor

Part 1910

Occupational Safety and Health  
Standards

###### 1.1.1.2 Federal Standards (FED STD)

FED-STD-313C

Material Safety Data,  
Transportation Data, And  
Disposal Data For Hazardous  
Materials Furnished To  
Government Activities

###### 1.1.1.3 Washington Administrative Code (WAC)

Title 173

Department of Ecology

Chapter 173-303

Dangerous Waste Regulations

##### 1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Hazardous Materials: Submit list of hazardous materials to be used. Include current Material Safety Data Sheet for each material.

1.2.2 Hazardous Material Storage: Submit proposed method for storage of materials.

1.2.3 Hazardous Waste: Submit physical descriptions and quantity of waste and waste containers to be generated.

1.2.4 Control of Hazardous Energy: Submit lockout/tagout procedures and training certifications for employees.

1.2.5 Excavation Shoring Design: Submit a shoring design for excavation of the 234-ZA tank pad and sump. Shoring design will show how to avoid disturbing the abandoned two 2" stainless steel lines which are potentially radioactively contaminated.

### 1.3 HAZARDOUS MATERIAL REQUIREMENTS

1.3.1 Hazardous products, defined in Section 111 of the Contract General Conditions, whether specified, recommended, or voluntarily requisitioned by Contractor, shall be governed by requirements of FED-STD-313 and Section 111 of the Contract General Conditions.

### 1.4 DANGEROUS WASTE HANDLING REQUIREMENTS

1.4.1 Dangerous waste, defined in WAC Chapter 173-303, generated by Contractor at Project shall be turned over to KEH for disposal.

1.4.2 Contractor personnel who handle, transfer, accumulate, or otherwise work with dangerous waste shall be trained by KEH to the requirements of WAC Chapter 173-303-330.

1.4.3 Report dangerous waste or hazardous material spills to KEH immediately.

1.4.4 After identification of dangerous waste to be generated, a satellite accumulation area will be designated for Contractor to deposit waste.

1.4.5 Identify and package dangerous wastes as approved or directed by KEH.

### 1.5 CONTROL OF HAZARDOUS ENERGY

1.5.1 Conform to lockout/tagout requirements of 29 CFR 1910.147.

1.5.2 Establish an energy procedure and training plan with provisions for the following.

1.5.2.1 Isolation or inactivation of hazardous energy sources before performing work thereon. A hazardous energy source is defined as a machine or equipment item with the potential for causing injury by unexpected energizing, startup, or stored energy release.

1.5.2.2 Certification of the accomplishment and currency of appropriate training. Certification shall include employee's names and training completion dates.

1.5.3 Coordinate lockout/tagout operations with KEH.

### PART 2 - PRODUCTS

Not Used

### PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01200  
PROJECT MEETINGS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 PROCEDURES

1.3.1 Representatives from KEH, Contractor, and major subcontractors shall participate in project meetings. Representatives from Operating Contractor and DOE may attend as required by items to be discussed.

1.3.2 Meeting times and locations shall be mutually agreed to by Contractor and KEH and will be held at the Hanford Site in Richland, Washington, except informal design reviews. KEH will issue notices of meetings and prepare meeting minutes which will be distributed to project participants.

1.4 SITE LABOR CONFERENCE

1.4.1 Before starting construction onsite, conduct informational conference on Hanford Site labor requirements applicable to Project. KEH will provide meeting notice to representatives from labor organizations, identified by Contractor, whose members may be utilized in construction and are to attend conference. Contractor shall present proposed work plan and craft utilization, and review Contract General Conditions relating to labor.

1.5 PRECONSTRUCTION

1.5.1 Meeting will be scheduled by KEH before start of onsite work. Authorized representatives of Contractor and major subcontractors shall attend and KEH will advise others having interest in Work. Meeting will be chaired by KEH.

1.5.2 Following items, as minimum, will be incorporated into agenda for meeting.

1.5.2.1 Point of contact and key personnel representing Operating Contractor, Safety, QA/QC, Acceptance Inspectors, and Construction Engineers.

1.5.2.2 Schedule requirements and restraints, submittals and work limitations.

1.5.2.3 Safety, construction progress meetings and frequency, and certified payrolls.

1.5.2.4 Report requirements and frequency.

1.5.2.5 Quality requirements.



1.5.2.6 Major material and equipment lists.

1.5.2.7 Other pertinent items.

1.6 CONSTRUCTION PROGRESS

1.6.1 Meetings held biweekly at time and location determined at preconstruction meeting will be approximately one hour long.

1.6.2 KEH will chair meeting and request attendance of key personnel required. Authorized representatives of Contractor and pertinent subcontractors shall attend.

1.6.3 Purpose of meetings is to monitor status and provide forum for exchange of pertinent information related to the Work. Major topics may include, but not be limited to, following.

1.6.3.1 Schedule, cost, and construction status.

1.6.3.2 Design and scope changes.

1.6.3.3 Submittal status, key material, and equipment delivery status.

1.6.3.4 Potential problem areas.

1.6.3.5 Inspection and testing status.

1.6.3.6 Action item status, goals for next meeting.

1.6.3.7 Other appropriate items.

1.6.4 Meeting minutes will be issued by KEH as promptly as possible following meeting. Action items will be identified with assigned follow-up. Issues resolved will be reported in minutes, as well as closed action items.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 01300

### SUBMITTALS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

1.1.1 This Section summarizes submittals required in Contract General Conditions and Part 1 of each section of this Specification. It explains type of submittals required, and describes procedures for submittals and review.

1.1.2 Submittals required are summarized in Article 1.3. Each submittal is identified by General Conditions and Specifications Section/Paragraph Number and Title. Submittals are required for either "Review and Approval" or "Review for Record".

1.1.2.1 Submittals requiring review and approval are to receive approval before procurement, fabrication, or construction is started.

1.1.2.2 Submittals requiring review for record are those on which procurement, fabrication, construction, or acceptance testing may proceed, but acceptance is contingent upon compliance with Drawings and Specifications.

##### 1.2 SUBMITTAL PROCEDURES

1.2.1 Transmit submittals to KEH by Data Transmittal form.

1.2.2 Identify each submittal by Section/Paragraph Number and Title noted in Article 1.3. Number of copies required for retention by KEH are shown in Summary and include 2 copies to be returned to Contractor. Additional copies required for Contractor uses shall be added.

1.2.3 Review each submittal for completeness, compliance with Contract Documents, and proper identification before sending to KEH. Submittal data shall either be stamped showing review process has taken place or Data Transmittal form may be signed with statement of "Reviewed for Compliance." Submittals not stamped or signed to show review will be returned without consideration.

1.2.4 Submittals requiring review and approval will be stamped by KEH and marked "Approved", "Approved with Exception" or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve Contractor of responsibility for errors contained therein.

1.2.4.1 Approved submittals are identified by submittal stamp with "Approved" or "Approved with Exception" box checked. "Approved" signifies general concurrence to achieve conformance with design concept of Project and compliance with requirements of Contract Documents. "Approved with Exception" signifies general concurrence with noteworthy comments or clarifications. Approval of specific item shall not be construed as approval of system or assembly of which item is a component.

1.2.4.2 A submittal which is not approved is identified as "Not Approved, Revise and Resubmit." Submittal is considered by KEH to be technically deficient or incomplete and therefore, unacceptable. Resubmittal is required, hence fabrication, procurement, or performance of procedures shall not proceed.

1.2.4.3 Upon receipt of deficient submittal data, make corrections noted on transmittal and resubmit data to KEH within 10 calendar days.

1.2.5 Materials and equipment fabricated or installed without required approved submittals, or which differ from approved Drawings or vendor data are subject to rejection and replacement at Contractor's expense.

1.2.6 Delays arising from failure to submit, in timely manner, required Drawings, and other related data described in Contract Documents, shall not constitute excusable delays for extensions, unless excusable under other provisions of Contract. Allow 15 calendar days for KEH review and disposition of submittals, including shop drawings and vendor information, required to be furnished. Time period will be measured from date of receipt of submittal in KEH's office to date of return mailing.

1.2.7 Contractor is responsible for dimensions to be confirmed and correlated at Project site.

1.2.8 Submittals for review and record will be reviewed and filed. Incomplete or inaccurate data will be returned marked "Resubmit" with appropriate comments, and items procured or work performed shall be corrected. Payment for equipment will not be made unless required vendor information has been furnished.

1.2.9 Procedures for performing certain items of work are required to be submitted for review and approval before work is commenced. Those work procedures which have been approved by KEH for work similar to that to be accomplished on Project may not need to be reapproved. Forward 1 copy of previously approved procedure to KEH by Data Transmittal form and identify by Section/Paragraph Number, Title, and either procedure number or project number for which procedure was approved. Submittal will be reviewed by KEH and if acceptable retained for record. If previously approved procedure is not acceptable submittal will be returned with requirements for resubmittal.

No.	General Conditions Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>CONTRACT GENERAL CONDITIONS</b>					
55.1		Certificates of First Aid Train- ing (WISHA requirements)	5	Before badging	
55.2		Safety Program and Job Safety Analysis	5	5 days before start of work	
55.3		Industrial Injury/Illness Experience	5	5 days before start of work and each month	
55.5.1		OSHA Form No. 200 Report	5		5th working day, each month
55.6		Equipment Certi- fication	5	2 days before bringing equipment onsite	

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>SPECIAL PROJECT PROCEDURES</b>					
01100/1.2.1		Hazardous Materials	6		5 days before material delivery
01100/1.2.2		Hazardous Materials Storage	6	5 days before material delivery	
01100/1.2.3		Hazardous Waste	6		5 days before material delivery
01100/1.2.4		Control of Hazardous Energy	6	5 days before start of work	
01100/1.2.5		Excavation Shoring Design	6	5 days before start of work	

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>PROGRESS SCHEDULES</b>					
	01310/1.3	Progress Schedule for duration of Contract	7	30 days after notice of award	
	01310/1.4	CPM Project Schedule	7	30 days after notice of award	
	01310/1.5	Initial Weekly Work Schedule	2	10 days after notice of award	
	01310/1.5	Subsequent Weekly Work Schedules	2	By noon each Friday	
<b>QUALITY ASSURANCE</b>					
	01400/1.2.1	Quality Assur- ance/Quality Control System	6	Before notice of award	
<b>CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS</b>					
	01500/1.2.1	Anchoring and Enclosure Methods	5	Before placing field office	
<b>PRODUCT OPTIONS AND SUBSTITUTIONS</b>					
	01630/1.2.2	Substitution Approval Request(s)	9	Before start of construction	
<b>EARTHWORK</b>					
	02200/3.1.1	Method to Prevent Damage During Excavation	7	Before excavation	
<b>HOT-LAID ASPHALTIC CONCRETE PAVING</b>					
	02512/1.2.1	Laboratory Reports	7	Before delivery	
<b>CAST-IN-PLACE CONCRETE</b>					
	03300/1.2.1	Reinforcing Steel Fabricator Drawings	7	Before delivery	

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
	03300/1.2.2	Concrete Materials, Mix Design, and Mix Proportions	7	Before mixing	
	03300/1.2.3	Certified Material Test Reports for Re-Steel	7	Before delivery	
<b>STRUCTURAL STEEL</b>					
	05120/1.2.1	Fabricator Drawings	7	Before fabrication	
	05120/1.2.2	Manufactures Certifications of High Strength Bolts	7	Before fabrication	
	05120/1.2.3	"Special Inspection Procedure" for installation of expansion anchors and anchor bolts.	7	Before fabrication	
<b>METAL FABRICATIONS</b>					
	05500/1.2.1	Fabricator Drawings	7	Before fabrication	
	05500/1.2.2	Manufacturer's Data	7	Before delivery	
<b>CUSTOM CASEWORK</b>					
	06410/1.2.1	Fabricator Drawings	7	Before fabrication	
	06410/1.2.2	Material Samples	7	Before delivery	
	06410/1.2.3	Plastic Laminate Colors	7	Before fabrication	
<b>INSULATION</b>					
	07200/1.2.1	Manufacturer's Data	7	Before delivery	
<b>JOINT SEALERS</b>					
	07900/1.2.1	Manufacturer's Installation Instructions	7	Before application	

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>METAL DOORS AND FRAMES</b>					
	08100/1.2.1	Fabricator Drawings	7	Before delivery	
<b>OVERHEAD COILING DOORS</b>					
	08331/1.2.1	Fabricator Drawings	7	Before delivery	
<b>DOOR HARDWARE</b>					
	08710/1.2.1	Hardware List	7	Concurrent with doors and frames	
<b>FIBER REINFORCED PLASTIC (FRP) WALL PANELS</b>					
	09300/1.2.1	Manufacture' Data	7	Before delivery	
<b>ACOUSTICAL TREATMENT</b>					
	09510/1.2.1	Installation Drawings	7	Before delivery	
	09510/1.2.2	Manufacturer's Data	7	Before delivery	
<b>SPECIAL PROTECTIVE COATING</b>					
	09805/1.2.1	List of Materials	7	Before delivery	
<b>PAINTING</b>					
	09900/1.2.1	List of Materials	7	Before delivery	
	09900/1.2.2	Color Samples	7	Before delivery	
<b>LOCKERS</b>					
	10500/1.2.1	Manufacturer's Data	7	Before delivery	
	10500/1.2.2	Color Samples	7	Before delivery	
<b>FIRE EXTINGUISHERS AND CABINETS</b>					
	10520/1.2.1	Approval Data	7	Before delivery	

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>FLUID WASTE TREATMENT AND DISPOSAL EQUIPMENT</b>					
11300/1.2.1	Approval Data	9	Before delivery		
11300/1.2.2	Vendor Information	11			Before Installation
11300/1.2.3	Design Fabrication Drawings	9	Before delivery		
<b>PRE-ENGINEERED STRUCTURES</b>					
13120/1.2.1	Erection Instructions and Diagrams	9	Before delivery		
13120/1.2.2	Certificates of Conformance or Compliance	9			At time of delivery
13120/1.2.3	Color Samples	9	Before delivery		
<b>INSTRUMENTATION</b>					
13440/1.2.1	Approval Data	9	Before delivery		
13440/1.2.2	Vendor Information	11			Before installation
<b>FIRE PROTECTION</b>					
15300/1.2.1	Approval Data	9	Before delivery		
15300/1.2.2	Vendor Information	11			Before Installation
15300/1.2.3	Design/Fabricator Drawings	9	Before fabrication		
15300/1.2.4	Record Drawings	9			After installation
15300/1.2.5	NFPA Test Certificate	9			Within 10 days after completion



No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>PLUMBING</b>					
	15400/1.2.2	Vendor Information	11		After installation
<b>CHEMICAL PLANT AND PETROLEUM REFINERY PIPING SYSTEMS</b>					
	15493/1.2.1	Approval Data	9	Before delivery	
<b>HEATING, VENTILATING, AND AIR CONDITIONING</b>					
	15500/1.2.1	Approval Data	9	Before delivery	
	15500/1.2.2	Vendor Information	11		After installation
	15500/1.2.3	Fabricator drawings	9		Before installation
	15500/1.2.4	Test and Balance Data	9		Within 10 days after test comple- tion
	15500/1.2.5	Control System Functional Verification Procedure	9	Before testing	
	15500/1.2.6	Control System Functional Verification Report	9		Within 10 days after test comple- tion
<b>SERVICE AND DISTRIBUTION</b>					
	16400/1.2.1	Approval Data	9	Before delivery	
	16400/1.2.2	Vendor Information	11		After installation

No.	Specifications Section/Para. Number	Submittal Title	Quantity	Review and Approval	Review For Record
<b>ALARM AND DETECTION SYSTEMS</b>					
	16720/1.2.1	Approval Data	9	Before delivery	
	16720/1.2.2	Vendor Information	11		Before installation
	16720/1.2.3	Installation Drawings	9	Before installation	
	16720/1.2.4	Record drawings	9		Within 10 days after test completion
	16720/1.2.5	Certificate of Compliance	9	Before installation	

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 01310

### PROGRESS SCHEDULES

#### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Progress Schedules: Submit following schedules required in Article 1.3.

1.2.1.1 Schedule covering activities for first 60 calendar days of Contract.

1.2.1.2 Schedule covering activities for duration of Contract, based on CPM Schedule required in Article 1.4.

1.2.2 CPM Project Schedule: Submit schedule required in Article 1.4.

1.2.3 Initial Weekly Work Schedule: Submit schedule required in Article 1.5.

1.2.4 Subsequent Weekly Work Schedules: Submit schedules required in Article 1.5.

#### 1.3 PROGRESS SCHEDULES

1.3.1 Schedules identified in Section 5 of the Contract General Conditions shall be in accordance with following.

1.3.1.1 Show order Contractor proposes to carry on the Work, starting dates of the several salient features of the Work including procurement of materials and equipment, and contemplated dates for completion. Each schedule shall be in form of bar chart of suitable scale to show percentage of Work scheduled for completion at any time with separate bar for each activity. At end of each week or at end of other periods of time specified in Contract, prepare and submit one copy of chart showing actual progress at end of period.

1.3.2 Organize schedule to show activities relative to each major subcontractor and supplier. Provide subschedule to define critical portions of entire schedule.

1.3.3 Schedule shall include design activities and milestones, delivery date of design documents, construction activities, progress milestones, and include, but not be limited to, following activities.

1.3.3.1 Bond and insurance.

1.3.3.2 Submittal schedule.

- 1.3.3.3 Mobilization.
- 1.3.3.4 Earthwork.
- 1.3.3.5 Concrete work.
- 1.3.3.6 Structural steel.
- 1.3.3.7 Pipe fabrication.
- 1.3.3.8 Install piping.
- 1.3.3.9 Install equipment.
- 1.3.3.10 Install instrumentation.
- 1.3.3.11 Install electrical conduit and wiring.
- 1.3.3.12 Install HVAC and air sampling equipment.
- 1.3.3.13 Install fire protection system.
- 1.3.3.14 Testing and nondestructive examination.
- 1.3.3.15 Stabilization.
- 1.3.3.16 Paint.
- 1.3.3.17 Tie-in to existing systems.
- 1.3.3.18 Deliver record documents.
- 1.3.3.19 Contract closeout.
- 1.3.3.20 Demobilize.

1.3.4 Schedule shall show, as minimum, accumulated percentage of completion of each activity and total percentage of work completed as of last work day of each month.

1.3.4.1 Develop an "S" curve from percentage of total work figures and superimpose on schedule.

1.3.4.2 Show dollar value or percentage of total next to each activity shown on schedule. Figures will be basis for determining progress payments described in Section 01027.

#### 1.4 CPM PROJECT SCHEDULE

1.4.1 Prepare schedule identifying critical path activities which include logical sequence and relationship of activities for engineering, design, submittals, procurement, fabrication, delivery, erection, installation, and testing of work covered by Contract.

1.4.2 Activity durations shall be working days. Subdivide activities exceeding 20 working days by identifying logical subactivities. Activity titles shall be self-explanatory with abbreviations shown in legend on document. Show early start, early finish, late start, late finish, restraining activities, and total float for activities. Highlight critical path activities to identify Project's critical path.

1.4.3 Schedule shall include the following.

1.4.3.1 Significant engineering functions performed before fabrication, such as preparation of specific procedures, and shop and field drawings, that must be submitted for approval. Include necessary approval dates.

1.4.3.2 Major material acquisitions and delivery dates.

1.4.3.3 Offsite fabrication schedules and delivery dates.

1.4.3.4 Subcontractor activities.

1.4.3.5 Field installation and nondestructive examination activities.

1.4.3.6 Identification of activities requiring work performed outside of the regular day shift hours specified in Section 01043. Indicate if the work will require second or third shifts, or 6 or 7 day work weeks.

1.4.3.7 Identification of inspection hold points.

1.4.3.8 Manpower loading and leveling.

1.4.3.9 Milestones indicating interface requirements with construction activities performed by others.

#### 1.5 WEEKLY WORK SCHEDULE

1.5.1 Prepare initial and subsequent detailed schedules of next week's work. Schedule shall include following as minimum.

1.5.1.1 Work description.

1.5.1.2 Detailed location of work.

1.5.1.3 Total number of work force by location.

1.5.1.4 Work involving outages, overtime, weekends, etc.

#### 1.6 REVISIONS TO SCHEDULES

1.6.1 Whenever KEH determines there are significant variances between actual and scheduled progress, endangering completion within Contract completion time, Contractor may be required to prepare and submit revised schedules.

1.6.2 Show progress to date of submittal and projected completion date of each activity. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

1.6.3 Provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including changes on schedules of separate contractors.

1.6.4 Distribute copies of revised schedules to KEH Project file, subcontractors, suppliers, and other concerned entities. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in revised schedules.

1.6.5 If Contractor fails to submit progress schedule specified in Paragraph 1.3.1 within prescribed time, or revised schedules specified in Paragraph 1.6.1, within requested time, KEH may withhold approval of progress payments until time Contractor submits required schedules.

## 1.7 MILESTONES

1.7.1 The following milestones shall be adhered to and included in the Progress Schedules and the CPM Project Schedule:

1.7.1.1 The submittals for the Low Level Waste Treatment Facility building will be submitted 30 days after award of contract to allow approval within 45 days after award.

1.7.1.2 The concrete pours for buildings 234-ZA and 234-Z will be completed 100 days after notice to proceed.

1.7.1.3 Significant completion of construction to enable pretesting of Acceptance Tests will be completed 310 days after notice to proceed.

## PART 2 - PRODUCTS

Not Used

## PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01400  
QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Quality Assurance/Quality Control System: Submit a quality assurance plan (QAP) meeting the requirements of Section 14 of the Contract General Conditions, and specific Contractor QAP requirements contained herein.

1.3 SPECIFIC CONTRACTOR QAP REQUIREMENTS

1.3.1 Requirements of paragraphs 1.3.4 through 1.3.7 apply to the following Contract work elements.

1.3.1.1 Design control, subparagraph 1.3.4.2 applies only to the following:

- a) Fiberglass reinforced plastics tanks,
- b) Pre-engineered structure,
- c) and Fire protection wet pipe sprinkler system.

1.3.2 The requirements of paragraphs 1.3.3 apply to the installation of the ACT-1 HVAC building exhaust system.

1.3.3 Provide a documented QAP which satisfies the following criteria: ASME NQA-1 basic requirements 1, 5, 6, 9, 10, 11, 12, 14, 15, and 17.

1.3.4 Provide a documented QAP which satisfies the following criteria. If the QAP is based on a national standard, furnish a matrix which cross-references the plan with corresponding requirements listed.

1.3.4.1 Organization: The identity, authority, and functions of the individual(s) responsible for contractor design and construction activities shall be documented.

1.3.4.2 Design control: Define and control Contractor design activities to including the following:

- a. Use of qualified personnel.
- b. Identification of sources of inputs for design including procurement document technical requirements, codes, standards, and KEH authorized changes.

c. Checking of design documents by qualified personnel, not responsible for performing the design, to assure that design inputs are correctly incorporated into final design documents.

1.3.4.3 Document control: Ensure that the latest approved issue of procurement documents and design media are used for design and construction activities. Such documents including changes thereto, shall be reviewed for adequacy and approved for release by authorized personnel. Records shall be legible, identifiable, and retrievable.

1.3.4.4 Inspection and Testing:

a. Perform inspections and tests specifically required by contract documents, including minimum code and standard requirements.

b. Inspection and testing requirements shall be described by clear, complete, and current procedures and instructions. Test procedures shall include reference test objectives and provisions for ensuring that prerequisites for inspections and tests have been met.

c. Document and review inspections for compliance with requirements. Documented inspections shall report true physical/functional conditions of an inspected activity. Documentation of inspections and tests shall be submitted or delivered as required by Contract requirements.

1.3.4.5 Control of Measurement and Test Equipment (M&TE):

a. Testing shall be performed using calibrated equipment when required by the design document. Equipment shall be calibrated at established intervals to ensure continued accuracy. Calibrations shall use certified measurement standards which have known, valid relationships to national standards.

b. Maintain records and mark equipment to show calibration status.

c. Notify KEH when M&TE is found to be out of calibration after being used on KEH procurement.

1.3.4.6 Inspection and Test Status:

a. The supplier shall maintain a positive system for identifying inspection and testing status of items or systems.

1.3.4.7 Control of Nonconforming Items:

a. Provide a method of notification for all construction items and activities which do not conform to requirements. Notification shall be given to the person identified in Contract documents.

1.3.5 KEH may review/audit Contractor compliance with the QAP and Contract Documents.

1.4 INSPECTING AND TESTING



1.4.1 In accordance with Section 19 of the Contract General Conditions, Contractor will perform the following:

1.4.1.1 Examine weldments made in accordance with Section 05120, paragraph 3.2.

1.4.1.2 Examine welding of metal fabrications in accordance with Section 05500, paragraph 3.1.1.

1.4.1.3 Leak/pressure test the Fluid Waste Treatment and Disposal Equipment in accordance with Section 11300, paragraph 3.2.1.

1.4.1.4 Inspect final sealing of wall and roof joints in accordance with section 13120, paragraph 3.2.

1.4.1.5 Pneumatic tests of the Instrument lines in accordance with Section 13440, paragraph 3.2.1.

1.4.1.6 Electrical tests of the Instrument wiring in accordance with Section 13440, paragraph 3.2.2.

1.4.1.7 Flushing and hydrostatic testing of Fire Protection system in accordance with Section 15300, paragraph 3.2.1.

1.4.1.8 Visual Examination of plumbing joints in accordance with Section 15400, paragraph 3.2.1.

1.4.1.9 Hydrostatic testing of plumbing piping in accordance with Section 15400, paragraph 3.2.2.

1.4.1.10 Test cold sanitary water lines in accordance with Section 15400, paragraph 3.2.3.

1.4.1.11 Test soil and vent lines in accordance with Section 15400, paragraph 3.2.4.

1.4.1.12 Perform Nondestructive Examination of welds (bonds) in accordance with Section 15493, paragraph 3.2.1.

1.4.1.13 Leak/pressure test the Fluid Waste Piping Systems in accordance with Section 15493, paragraph 3.2.2.

1.4.1.14 Testing and Balancing the HVAC systems in accordance with Section 15500, paragraph 3.2.1.

1.4.1.15 General testing of the electrical equipment in accordance with Section 16400, paragraph 3.3.1.

1.4.1.16 Testing of the electrical motors in accordance with Section 16400, paragraph 3.3.2.

1.4.1.17 General testing of the electrical wiring in accordance with Section 16400, paragraph 3.3.3.

1.4.1.18 General testing of the Alarm and Detection systems in accordance with Section 16720, paragraph 3.3.1.

1.4.1.19 Testing of the Fire Alarm Battery in accordance with Section 16720, paragraph 3.3.2.

1.4.1.20 Fire Alarm Acceptance Test Procedure in accordance with Section 16720, paragraph 3.3.3.

1.4.2 In accordance with Section 19 of the Contract General Conditions, KEH will perform the following.

1.4.2.1 Perform sampling and testing of Soil Compaction in accordance with Section 02200, paragraph 3.3.1.

1.4.2.2 Perform sampling and testing of Hot-Laid Asphalt Concrete Paving in accordance with Section 02512, paragraph 3.2.1.

1.4.2.3 Perform sampling and testing of Cast in-place Concrete in accordance with Section 03300, paragraph 3.3.1.

1.4.2.4 Perform inspection of anchor bolts in accordance with Section 03300, paragraph 3.3.2.

1.4.2.5 Perform Nondestructive Weld Examination of Structural Steel in accordance with Section 05120, paragraph 3.2.1.

1.4.2.6 Perform inspection of anchor bolts in accordance with Section 05120, paragraph 3.2.2.

1.4.2.7 Perform Nondestructive Weld Examination of Metal Fabrications in accordance with Section 05500, paragraph 3.1.2.

1.4.2.8 Perform inspection of anchor bolts in accordance with Section 05500, paragraph 3.1.3.

1.4.2.9 Perform inspection and testing of Special Protective Coatings in accordance with Section 09805, paragraph 3.4.1.

1.4.2.10 Perform inspection and testing of Painting in accordance with Section 09900, paragraph 3.4.1.

1.4.2.11 Perform visual weld inspection in accordance with Section 15300, paragraph 3.1.14.4.

1.4.2.12 Perform survey of piping system in accordance with Section 15493, paragraph 3.2.2.2.e.

1.4.2.13 Perform visual examination for leaks during pressure testing of pipe code M-3 in accordance with Section 15493, paragraph 3.2.2.3.a.

1.4.2.14 Perform adjusting and balancing of HVAC in accordance with Section 15500, paragraph 3.2.1.1.

1.4.2.15 Perform visual examination of structural welds in accordance with Section 15500, paragraph 3.2.2.

1.4.2.16 Perform examination in accordance with Section 16400, paragraph 3.3.1.

1.4.2.17 Perform examination in accordance with Section 16720, paragraph 3.3.1.

1.4.2.18 Perform examination of installation in accordance with Section 16720, paragraph 3.3.2.

1.4.2.19 Witness Acceptance Test Procedure in accordance with Section 16720, paragraph 3.3.3.

1.4.2.20 Witness specific inspection and witness points.

1.4.2.21 Perform final acceptance inspection.

1.4.3 Specific Inspection Points.

1.4.3.1 Adhere to inspection points. Ensure that personnel have completed inspections of, and approved portions of work in accordance with Contract requirements before notifying KEH.

a. Specific inspection points are defined as follows.

1) Construction inspection hold (H): Those activities in the sequence of construction which have been selected for mandatory inspection by KEH Acceptance Inspection. The contractor shall notify KEH Acceptance Inspection of those activities at least four hours in advance (unless otherwise noted of the activity). Work shall not proceed until the Acceptance Inspection Inspector ascertains that all necessary inspections have been accomplished.

2) Receiving (R): Those fabrications, equipment, and/or materials which have been selected for inspection by KEH upon arrival at a designated location, normally the job site. The contractor shall notify KEH Acceptance Inspection of the arrival of such items within four hours after receipt.

3) Witness (W): Those activities in the sequence of construction which have been selected for inspection at the option of KEH Acceptance Inspection. The contractor shall notify KEH Acceptance Inspection of those activities at least four hours in advance of the activity. Work may proceed, however, upon verbal release by the KEH Acceptance Inspection Inspector, or upon the expiration of one hour past the scheduled time of activity.

b. H, R, and W points apply to onsite work. Except where a longer period is specified, notify KEH at least four working hours before each point for onsite work.

1.4.3.2 H, R, and W points are listed in Article 1.7.

1.5 OPEN ITEM AND NONCONFORMANCE REPORTING

1.5.1 KEH utilizes Open Item Reports and Nonconformance Reports (NCRs) to document deviations from Contract requirements.

1.5.1.1 Open Item Reporting: Documented on the Open Items List available from KEH. Items shall be corrected by the Contractor without additional

direction. Correction shall bring item into compliance with Contract requirements, using approved rework procedures or standards, without violating Contract requirements.

1.5.1.2 Nonconformance report: Documented on nonconformance report (NCR) forms. NCR's document deviations from Contract requirements when characteristic, documentation, or procedure renders quality of an item or activity unacceptable, or indeterminate. Nonconformances are identified by a red construction hold tag, or blue NCR tag. A hold tag prohibits movement, installation, processing, or further fabrication of nonconforming items pending approval of the NCR disposition. An NCR tag identifies a nonconformance, but allows work to proceed based on an approved NCR disposition. No action shall be taken to correct or alter an actual condition before receipt of an approved disposition. Tags are not to be removed by anyone other than the agency who applied the tag.

1.5.2 The Contractor shall ensure its organization is represented by individuals with sufficient authority to commit the Contractor to corrective action requirements identified by KEH.

1.5.3 Open items and nonconformances reported during performance of the Contract require resolution before completion and final payment.

#### 1.6 QAP DOCUMENTATION

1.6.1 Provide documentation developed from QAP requirements.

## SCHEDULE FOR H, R, AND W POINTS

Earthwork

- H - All Compaction Procedure Demonstration
- W - All Structural Backfilling

Hot-Laid Asphaltic Concrete Paving

- W - All Paving

Cast-In-Place Concrete

- H - All Concrete Pours
- W - Anchor Bolts

Structural Steel

- H - Initial Welding - Onsite
- W - Anchor Bolts

Metal Fabrications

- H - Initial Welding - Onsite
- W - Anchor Bolts

Overhead Coiling Doors

- W - Functional testing of Doors

Special Protective Coating

- R - Prior to opening Containers of Coating Material
- W - All application of special protective coating

Painting

- H - Initial Painting

Fluid Waste Treatment and Disposal Equipment

- R - Fiberglass (FRP) Tanks, Sump Pumps, Feed Pumps, Effluent Pumps, Recycle Pump, Static Mixer, KOH Addition System, Samplers, Filters, Process Canisters and Canister Dolly
- W - Final setting of FRP Tanks
- H - All Leak/Pressure Testing
- H - All Acceptance Testing (ATP-002)

Pre-Engineered Structures

- R - Prefabricated Components
- W - Final Sealing at Wall and Roof Joints

Instrumentation and Controls

- R - All materials requiring Vendor Data
- H - All Leak/Pressure Testing
- W - All Electrical Testing
- H - All Acceptance Testing (ATP-002)

Fire Protection

- H - Initial Welding of Supports
- W - All Flushing of Sprinkler System
- H - All Hydrostatic Testing

Plumbing

H - All Leak/Pressure Testing

Fluid Waste Piping System

R - Piping and Valves

H - All Final Tie-Ins

W - Flushing prior to Leak Testing

H - All Leak/Pressure Testing

W - All Holiday Testing

Heating, Ventilating and Air Conditioning

R - Air Clean Up Train (ACT-01) at Site

H - Initial Welding

H - Testing and balance of HVAC Systems

Service and Distribution

R - Motor Control Center and Transformers

W - Initial sealing of Fire Barriers

W - Initial Exothermic Welding (Cadwelding)

W - Anchoring of Motor Control Centers

W - All Electrical testing

H - Final Closure of Electrical Enclosures

Alarm and Detection Systems

R - Control Panel

W - All Electrical Testing

H - All Acceptance Testing (ATP-001)

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 01500

### CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

###### 1.1.1.1 National Fire Protection Association (NFPA)

701 Fire Tests for Flame-Resistant  
Textiles and Films, 1989  
Edition

###### 1.1.1.2 Washington State Department of Transportation (WSDOT)

M41-10-88 Standard Specifications for  
Road, Bridge, and Municipal  
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Anchoring and Enclosure Methods: Submit methods proposed for anchoring portable structures and enclosing underfloor area to meet the requirements of this Section.

##### 1.3 CONSTRUCTION FACILITIES

1.3.1 First Aid: Facilities are available at Building 2719WA in the 200 West Area to provide first line medical attention.

1.3.2 Operation and Storage Areas: Confine onsite operations, including storage of materials, to area shown on the Drawings.

1.3.3 Disposal Site for Waste: Dispose of excess excavation, broken asphalt, and broken concrete at the Hanford Site Central Landfill approximately 30 road miles from Project. A Solid Waste Disposal Request shall be completed by the Contractor, and signed by the Radiation Technician prior to taking waste to the site. Forms are available from KEH. The site is open between 8:30 a.m. and 2:30 p.m.

##### 1.4 TEMPORARY UTILITIES

###### 1.4.1 Water

1.4.1.1 Construction: Available from existing hydrant in vicinity of Project site. Connect 4-1/2 inch, National Standard Thread, 1/4 turn ball valve with female swivel to 4 inch sexless "Snap-Tite/Storz" quick connect coupling to 4-1/2 inch port for fire department use. Install reduced pressure backflow preventer, similar to BEECO-AERGAP Model 6CM, and slow-

opening 2-1/2 inch gate valve to prevent water hammer on each hydrant port intended for construction use. Furnish hydrant wrench, backflow preventers and valves. Wrench shall remain on hydrant at all times. When used, turn hydrant "Full-on" or "Full-off". Partial opening causes damage to hydrant. Turn hydrant off at end of each work day. Provide freeze protection for hydrant and temporary piping or hoses. Fittings provided by Contractor for connection to water source shall be approved by KEH before installation. Remove temporary piping, hoses, fittings, and valves before final acceptance of the Work.

1.4.1.2 Drinking: Available within 200 West Area. Furnish adequate drinking water, that meets health and safety requirements, to employees.

1.4.2 Electric Power: A 480 volt transformer will be supplied to the job site. It will be located in the vicinity of building 291-Z. Furnish power lines or cable extensions, including transformers, protective equipment, switches, and fixtures beyond point of supply. Remove temporary installations upon completion of construction. Contractor must supply electrical power to the field office.

1.4.3 Telephone

1.4.3.1 Contractor will provide a cellular phone.

1.4.4 Sanitary Facilities: Furnish and service chemical or other approved sanitary toilets for employee use. Facilities shall meet requirements of KEH which are available upon request.

1.5 ACCESS ROADS AND PARKING AREAS

1.5.1 Access to 200 West Area shall be through main gate.

1.5.2 Parking for Contractor's Company vehicles will be made available in vicinity of the Work inside the Limited Area. "No Parking" signs are posted to show fire and emergency lanes. A limited number of contractor vehicles for transport of tools will be allowed in the PFP protected area. No personal vehicles will be allowed into the 200 West protected area under this contract.

1.5.3 Grass Fire Prevention: To reduce potential for grass fires, keep off-road driving to minimum. Vehicles driving off-road or to remote locations, shall carry a minimum 10 pound ABC dry chemical portable fire extinguisher, communications equipment consisting of 2 way radio or mobil phone (CB type radios are not acceptable), and shovel. Report fires immediately to nearest Hanford Patrol and Hanford Fire Department.

1.6 TEMPORARY CONTROLS

1.6.1 Dust Control: Maintain work areas to prevent hazard or nuisance to others. Accomplish dust control by sprinkling or other methods approved by KEH. Repeat sprinkling at necessary intervals to keep disturbed area damp at all times. Keep sufficient equipment on Project to accomplish dust control as work proceeds and whenever dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and cost shall be considered incidental to and included in Contract price.



1.6.2 Temporary Enclosures: Plastic sheeting materials used to form enclosures shall be minimum 14 mils thick and have fire retardant properties meeting the requirements of NFPA 701. Acceptable manufacturers are Winman Corp (Plastic Division), St. Cloud, Minnesota; Lancs Industries, Kirkland, Washington; and Protective Plastics, Inc, Greer, South Carolina.

1.6.3 Traffic Control: Temporary traffic control and barricades in accordance with WSDOT M41-10, Section 1-07.23(3).

1.6.3.1 Vehicle and equipment movement

a. Slow moving vehicles and equipment shall not travel on Hanford Site roads during heavy traffic periods between 6:30 and 8:00 am, and 3:30 and 5:30 pm.

b. Do not block existing roads.

c. Do not park on roadway shoulders.

1.6.3.2 Oversized vehicles and loads

a. Permits specified in Section 01065 are required for vehicles or loads exceeding following dimensions.

1) Width: 8'-6".

2) Height: 14 feet.

3) Length: Single unit, 40 feet.  
Single trailing unit, 48 feet.

b. Additional requirements for vehicles and loads exceeding 8'-6" width.

1) Display oversize load sign on front of towing vehicle and rear of trailing unit.

2) Attach red flags to each corner.

3) Notify KEH 5 days before moving loads.

4) Travel between 9:00 am and 2:30 pm unless special arrangements are made.

c. Escort vehicle requirements.

1) Equip with oversize load signs and amber lights.

2) Vehicles or loads over 10 feet wide: Provide escort cars in front and rear on 2 lane highways.

3) Vehicles or loads over 14 feet wide: Provide escort car in rear on multiple lane highways.

4) Vehicles or loads over 20 feet wide: Provide escort cars in front and rear on multiple lane highways.

d. Electrical escort requirements: KEH will provide qualified electrical escorts, at no cost to Contractor, when load reaches height of 14 feet or more from road surface, or when clearance of at least 6 feet cannot be maintained from overhead electrical or signal lines. Notify KEH at least 3 working days before escort is required.

#### 1.7 FIELD OFFICE

1.7.1 Establish a field office equipped and staffed to conduct the Work. Keep copies of Drawings, Specifications, and other information pertinent to the Work at office. KEH shall have access to documents at all times. Should Contractor elect to utilize portable or relocatable structures, requirements of Paragraph 1.7.2 shall apply.

1.7.2 Anchor or tie down portable or relocatable structures, including trailers for field offices and storage, to prevent overturning or lateral movement in winds up to 70 mph. Enclose or skirt underfloor area with material that will not burn or support combustion to prevent accumulation of wind-blown debris and use of underfloor space for material storage. Complete anchoring and enclosing, in accordance with approved submittal, within 14 days of arrival onsite.

#### 1.8 LAYDOWN AREA

1.8.1 Possible locations of field office (trailer) and laydown area are sketched on top of the site plan. The length and width of asphaltic walkways are also sketched.

#### 1.9 TEMPORARY AREA FOR SPOILS DEPOSITION

1.9.1 Spoils may be located in the vicinity of the treatment facility and tank pad. The 20 ft roadways must remain clear of spoils and laydown areas. The asphalt walkways may be covered with spoils, but must be cleared at job completion. Spoil pile to be 4 feet maximum over existing elevation. Backfilling will require prior notification by 3:00 PM day before work. Excess excavated soil must be disposed of in the Central Landfill.

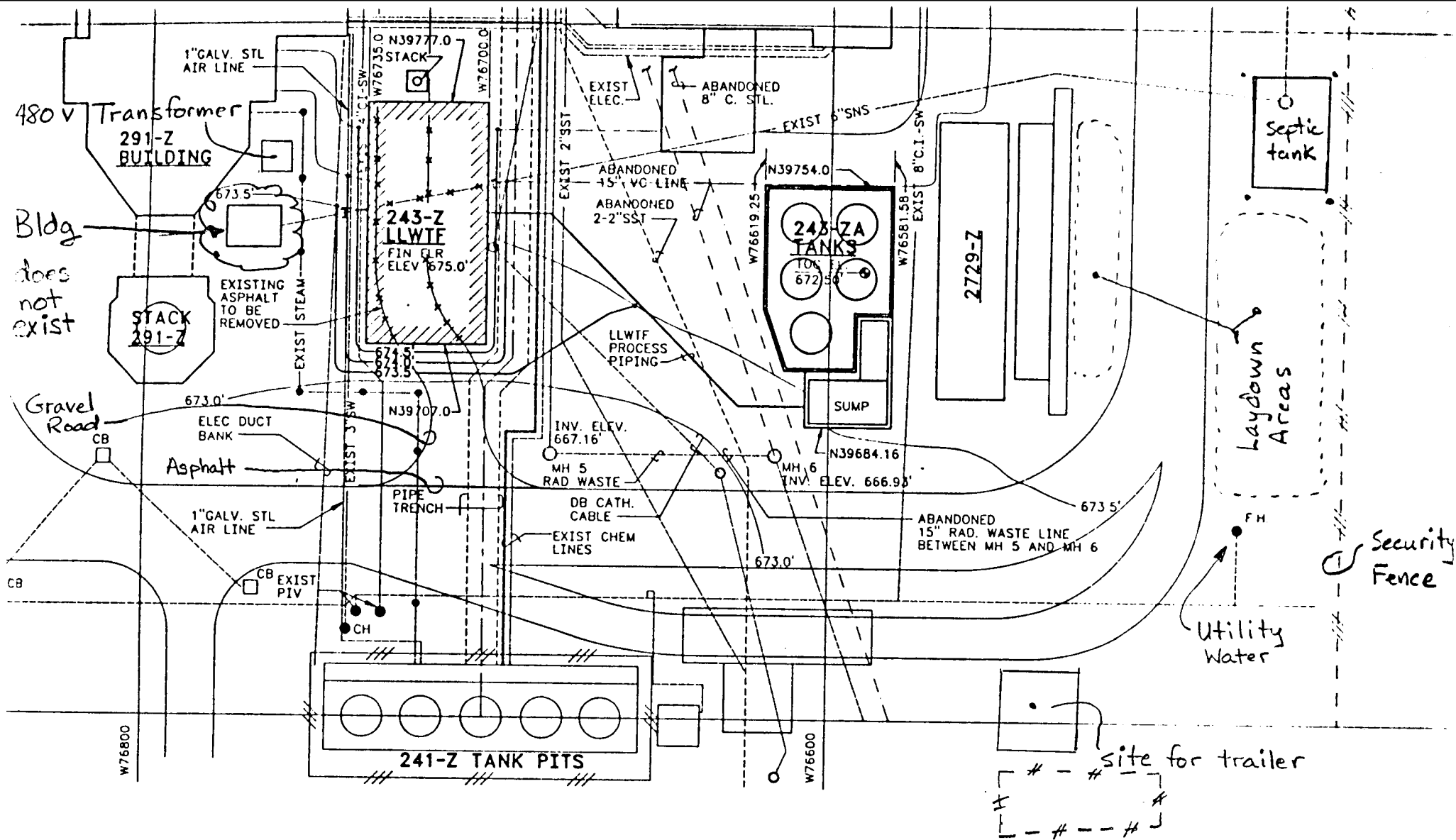
#### PART 2 - PRODUCTS

Not Used

#### PART 3 - EXECUTION

Not Used

END OF SECTION



**200 WEST AREA  
PARTIAL SITE PLAN**

SCALE: 1" = 20'

Sketch to show the Contractor  
the general areas for their  
use.

1"=20'  
scale feet

H-2-82629 SITE PLAN		E 90% SUBMITTAL D 70% SUBMITTAL 5/28/91			
NUMBER	TITLE	REV. NO.	DESCRIPTION	REV. DATE	APP. FOR SUBMITTAL DATE
DRAWING TRACEABILITY LIST		REVISIONS		NON APPROVALS	
NUMBERED ON		CAD FILE B0827110		CAD CODE 2D 18 02 10 0 NN	

00 0

N39900

N39900

Mh  
A/C

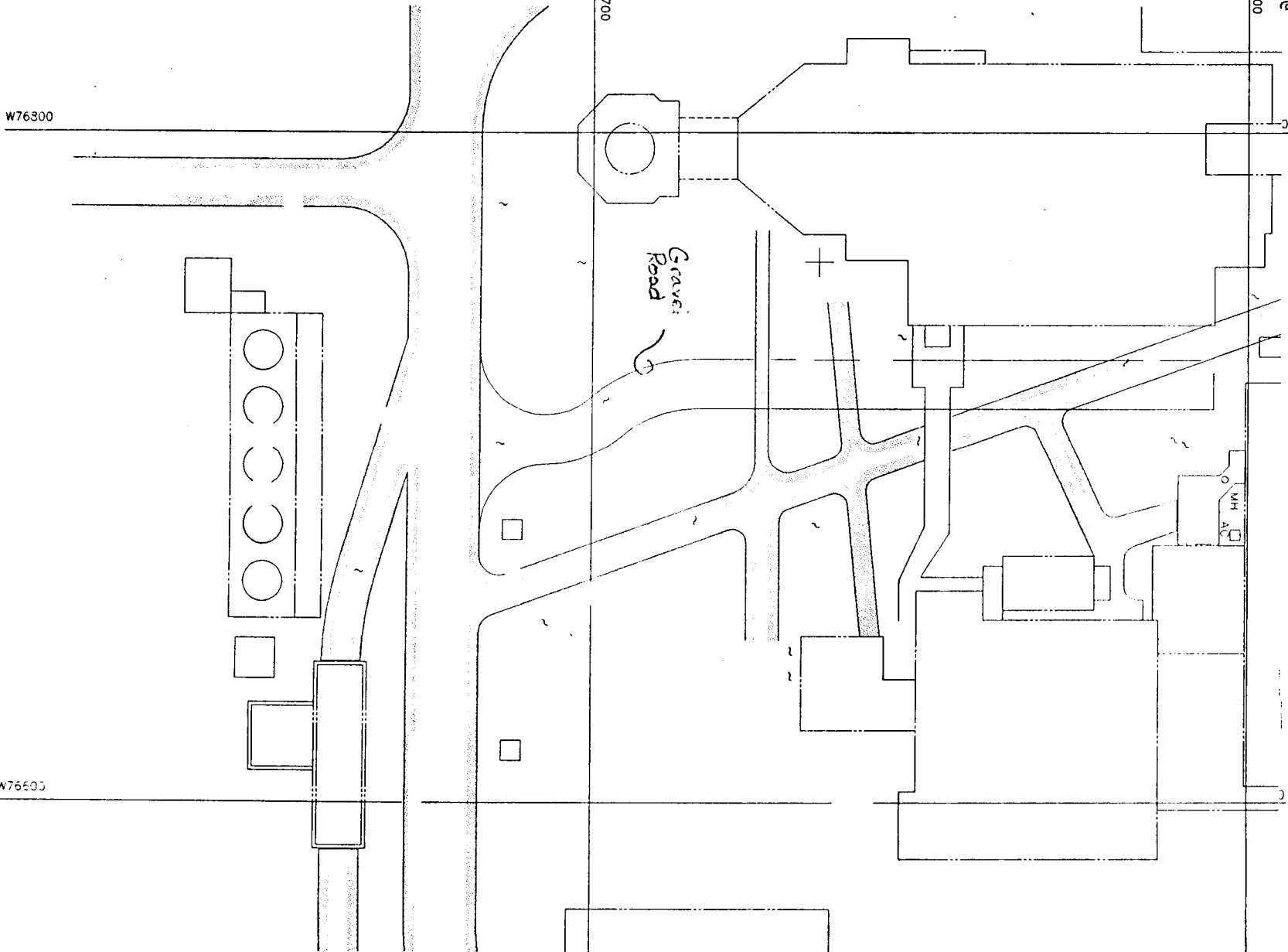
N39700

N39700

Grave:  
Road

W76300

W76300



## SECTION 01630

### PRODUCT OPTIONS AND SUBSTITUTIONS

#### PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Substitution Approval Request(s): Submit request(s) as required by Paragraphs 1.3.4 and 1.3.5, prepared in accordance with Article 1.6.

#### 1.3 SUBSTITUTIONS

1.3.1 Products include those items identified on the Drawings as well as in Part 2 of the Specification Sections.

1.3.2 Product options given in the Specification Sections represent functionally and physically similar items. In addition to generic type, form and size, physical similarity includes maintainability, reliability, and durability characteristics.

1.3.3 A substitute product may be used in place of a product or the product options identified in Specification Sections, without approval, if it is functionally and physically similar as defined above.

1.3.4 Substitution of a product that is functionally similar but physically dissimilar will require submittal of a Substitution Approval Request.

1.3.5 Submittal of a Substitution Approval Request is also required when a product callout in the Specification Sections includes the phrase "or an approved substitute".

1.3.6 Products required in quantity within Specification sections shall be the same and be interchangeable.

1.3.7 Do not use materials and equipment removed from existing structure, except as specifically required or allowed by Contract Documents.

#### 1.4 LIMITATIONS ON SUBSTITUTIONS

1.4.1 Substitutions will not be considered when indicated or implied on fabricator drawings, or product data submittals, without separate Substitution Approval Requests, when requested directly by subcontractors or suppliers, or when acceptance will require substantial revision of Contract Documents.

1.4.2 Substitute products that require a substitution approval request shall not be ordered or installed before the request is approved.

1.4.3 Only one Substitution Approval Request for each product will be considered. When a substitution is not accepted, provide specified product.

1.4.4 KEH will determine acceptability of substitution approval requests.

#### 1.5 REQUESTS FOR SUBSTITUTIONS

1.5.1 Submit a separate Substitution Approval Request for each substitution, using Form KEH-1151, sample included.

1.5.2 Identify products by Specification Section and Article or Paragraph numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.

1.5.3 To each Substitution Approval Request attach descriptive information for substitute and original products. The information shall consist of drawings, calculations, and data as appropriate to define operational and physical characteristics of products, and establish a basis for comparison.

1.5.4 Give an itemized comparison of proposed substitution with specified product, listing variations, with reference to Specification Section and Article or Paragraph numbers.

1.5.5 Give quality and performance comparisons between proposed substitution and specified product.

1.5.6 Give cost data comparing proposed substitution with specified product, showing the Contract Sum net change.

1.5.7 List availability of maintenance services and replacement materials.

1.5.8 State effect of the substitution on construction schedule, and changes required in other work or products. If a substitute product requires or necessitates revisions to structures, foundations, footings, services, systems, piping, electrical, etc., engineering costs shall be borne by Contractor. Submit drawings, calculations, and vendor data, clearly showing revisions to accommodate substitution, for approval.

1.5.9 KEH will review and disposition requests for substitutions within 10 working days, unless evaluation requires extensive comparison or consultation.

1.5.10 For accepted substitute products make the same submittals, in accordance with Section 01300, required for the original products.

1.6 CONTRACTOR REPRESENTATION

1.6.1 Request for substitution constitutes representation that Contractor has investigated proposed product, has determined that it is equal to or superior to that specified, and that cost reduction offered (if there is one) is ample justification for accepting offered substitution.

1.6.2 Provide same warranty for a substitute as for specified product.

1.6.3 Coordinate installation of accepted substitutes, making changes required for work to be completed.

1.6.4 Certify that cost data presented is complete, and includes related costs under the Contract.

1.6.5 Waive claim for additional costs related to substitutions which may later become apparent.

1.6.6 Waive claim for additional performance time resulting from product substitutions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

From (Contractor) \_\_\_\_\_ Contract No. \_\_\_\_\_

Project \_\_\_\_\_

Description of Proposed Substitution \_\_\_\_\_  
\_\_\_\_\_

We hereby submit for consideration the following product instead of specified item for above project:

Specification No. \_\_\_\_\_ Section \_\_\_\_\_

Drawing No. \_\_\_\_\_ Section or Zone \_\_\_\_\_

Specified Item \_\_\_\_\_

Proposed Substitution \_\_\_\_\_

Attach complete technical data, including laboratory tests and samples, as applicable.

Provide detailed comparison of the significant qualities (system performance, interface requirements, size weight, durability, performance and similar characteristics, and including visual effect where applicable) for the proposed substitution of comparison with the original requirements.

Describe other changes to drawings and specifications required by proposal as outlined below and attach additional information as necessary.

**Complete Each Item**A. Changes to drawing dimensions \_\_\_\_\_  
\_\_\_\_\_B. Effect of substitution on other systems \_\_\_\_\_  
\_\_\_\_\_C. Outline differences between proposed substitution and specified item \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

D. Manufacturer's guarantees of proposed and specified items are:

\_\_\_\_\_ Same \_\_\_\_\_ Different (explain on attachment)

Undersigned attests function, and quality equality equivalent or superior to specified item and has reviewed General Conditions paragraph GC-13 for assignment of responsibility if the substitution is approved.

Submitted By

Signature

Address

Date

Phone



From (Contractor) \_\_\_\_\_ Contract No. \_\_\_\_\_

Project \_\_\_\_\_

Description of Proposed Substitution \_\_\_\_\_

We hereby submit for consideration the following product instead of specified item for above project:

Specification No. \_\_\_\_\_ Section \_\_\_\_\_

Drawing No. \_\_\_\_\_ Section or Zone \_\_\_\_\_

Specified Item \_\_\_\_\_

Proposed Substitution \_\_\_\_\_

Attach complete technical data, including laboratory tests and samples, as applicable.

Provide detailed comparison of the significant qualities (system performance, interface requirements, size weight, durability, performance and similar characteristics, and including visual effect where applicable) for the proposed substitution of comparison with the original requirements.

Describe other changes to drawings and specifications required by proposal as outlined below and attach additional information as necessary.

Complete Each Item

A. Changes to drawing dimensions \_\_\_\_\_

B. Effect of substitution on other systems \_\_\_\_\_

C. Outline differences between proposed substitution and specified item \_\_\_\_\_

D. Manufacturer's guarantees of proposed and specified items are:

\_\_\_\_\_ Same \_\_\_\_\_ Different (explain on attachment)

Undersigned attests function, and quality equality equivalent or superior to specified item and has reviewed General Conditions paragraph GC-13 for assignment of responsibility if the substitution is approved.

Submitted By _____		Signature _____	
Address _____		Date _____	
		Phone _____	

KEM-1151 00 (10.87)

END OF SECTION

01630 - 4

 11/91  
Rev 0

SUBSTITUTION APPROVAL REQUEST

(KEH-1151.00)

END OF SECTION

SECTION 01720  
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington Administrative Code (WAC)

Title 296	Labor and Industries
Chapter 296-155	Safety Standards for Construction Work

1.2 SUBMITTALS: Not Used

1.3 RECORD REQUIREMENTS

1.3.1 The nature of work at the Hanford Site requires certain documents, defined herein, be held to record construction process and administration of the Contract. KEH will assemble pertinent data for final disposition. Prepare, preserve, and deliver project record documents required by this Contract to KEH. Documents are in addition to submittals required in Section 01300.

1.3.2 Mark project record documents to identify copies for record and to prevent use for construction. Keep record copies of construction documents in field office and make available to KEH during progress of Work.

1.3.3 Some data required for project records shall be delivered to KEH during course of construction and contract administration, while others shall be assembled after completion of construction for delivery to KEH. Document delivery by retaining copy of reports delivered during course of work until construction completion, retaining copy of letter of transmittal itemizing delivered items, or other means acceptable to KEH.

1.4 DOCUMENT IDENTIFICATION

1.4.1 General: Documents required for project records are itemized herein. Identify complete documents by title or number. Notes or markings added by hand shall be legible utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

1.4.2 Storage and Marking: Store one set in the field office, apart from documents used in construction, and maintain in clean, dry, and legible condition. Legibly mark items to record actual construction, including changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

1.4.3 Activity and Administrative Documents: Deliver or retain in accordance with following.

1.4.3.1 Certified Payrolls: Each week deliver certified payrolls, as required by Section 108 of Contract General Conditions, to KEH, and keep copies in the field office until Contract completion. Progress payments will not be processed unless certified payrolls for work periods have been received by KEH.

1.4.3.2 Daily Force and Equipment Reports: Before noon each day, deliver one copy of a detailed daily force report, covering labor and supervision of Contractor and subcontractors for previous day. Report shall include a general description of work performed, and list major items of equipment on site.

1.4.3.3 Weekly Manpower Reports: Prepare weekly manpower reports and deliver, before 10 am on Monday, for previous week, during performance of Contract. Forms will be furnished by KEH.

1.4.3.4 Weekly Safety Meetings: Conduct weekly walkaround safety inspections and safety meetings in accordance with WAC-296-155-110. Deliver one copy of meeting minutes to KEH, as completed.

1.4.3.5 Periodic Equipment Inspections: Document initial and followup, periodic heavy equipment inspections by the Contractor. Deliver one copy to KEH, as completed.

1.4.3.6 Backfill Permit: Retain backfill permits approved for work required in Division 2.

1.4.3.7 Soil Compaction Procedure: Retain Forms KEH-0382 completed for work required in Division 2.

1.4.3.8 Pour Slips: After obtaining KEH approval of concrete pour slips required in Division 3, deliver copies to KEH, and retain Contractor copies until Contract closeout. After closeout deliver them to KEH.

1.4.3.9 Trip Tickets: Deliver copies to KEH with each truck load of concrete required in Division 3, and retain Contractor copies until Contract closeout. After closeout deliver them to KEH.

1.4.4 Construction, Quality Assurance, and Supporting Documents: Deliver in accordance with following when called for in specification sections.

1.4.4.1 Personnel Qualifications: Two copies of welder (bonder) qualifications, or of NDE personnel qualifications, 5 days prior to start of fabrication. Maintain additional copies at the project site.

1.4.4.2 Procedures: Two copies of welding (bonding) and NDE procedures, 5 days prior to first use. Maintain additional copies at the project site.

1.4.4.3 Drawings: Three copies of weld (bond) identification drawings, 5 days prior to start of fabrication.

1.4.4.4 NDE Records: One copy of weld (bond) NDE records within 5 days after NDE completion. These records may be either signed NDE record forms, or signed fabrication drawings with each weld (bond) bearing the inspector's stamp.

1.4.4.5 Material Properties Test Records: One copy of test results prior to delivery of material. These records are for acceptance tests of bulk materials and of lots or heats of preformed stock materials and parts.

1.4.4.6 Flushing/Cleaning Records: One copy of records verifying acceptable completion of flushing and cleaning, within 5 days after completion.

1.4.4.7 Leak/Pressure Testing Records: One copy of records verifying acceptable completion of leak and pressure testing, within 5 days after completion.

1.4.4.8 Electrical Testing: One copy of records verifying acceptable completion of electrical insulation, continuity, and grounding tests, within 5 days after completion.

1.4.4.9 Operational Testing: One copy of records of component or subsystem operational testing, within 15 days prior to the start of acceptance testing.

1.4.4.10 Completed Acceptance Test Procedure (Test Results): One copy of Acceptance Test Procedure, with test results and other required information entered, within 5 days after completion.

1.4.4.11 Completed Certificate of Compliance: One copy of completed Certificate of Compliance, based on the above completed acceptance test procedure, along with that procedure.

1.4.5 Product Samples and Manufacturer's Instructions: In addition to submittals required in Section 01300, and requirements of this Section, information received by Contractor (from suppliers) that documents products used, and how they were installed, shall be delivered to KEH for Project Records.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

## SECTION 02200

### EARTHWORK

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

D 653-90

Standard Terminology Relating  
to Soil, Rock, and Contained  
Fluids

1.1.1.2 Washington Industrial Safety and Health Act (WISHA)

Washington Administrative Code (WAC)

Title 296, Labor and Industries

Chapter 296-155 WAC, Safety Standards for Construction Work

Part N

Excavation, Trenching, and  
Shoring

1.1.1.3 Washington State Department of Transportation (WSDOT)

M41-10-91

Standard Specifications for  
Road, Bridge, and Municipal  
Construction

1.2 Submittals: Refer to Section 01300 for submittal procedures.

1.2.1 Shoring Design: Submit shoring design.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

2.1.1 General: Obtain select soils from excavation or other designated locations. Obtain onsite approval for soils.

2.1.2 Fill or Backfill

2.1.2.1 Structural: Well graded soil mixtures which may contain cobbles up to 3 inches in greatest dimension if uniformly distributed and not constituting more than 20 percent of volume of fill.

2.1.3 Bedding for Underground Pipe, Conduit and Cable: Sand, defined in ASTM D 653, or excavated sandy material having less than 20 percent gravel particles and maximum dimension of 1/2 inch.

2.1.4 Stabilization: Crushed rock, maximum size of particles 3/4 inch for walkways and 2 inch minus for other areas.

2.1.5 Plastic Sheet Marker: 6 inch wide nondetectable tape similar to "Terra Tape" manufactured by Griffolyn Co, Inc. Tape shall be imprinted with warning such as "Caution Buried Installation Below" at intervals of not more than 4 feet. Semi-metallic detectable tape shall be used above plastic pipe and non-metallic conduit.

### PART 3 - EXECUTION

#### 3.1 EXCAVATION

3.1.1 Before performing excavation, obtain excavation permit.

3.1.2 Locate and expose underground utilities by hand tools. Use of heavy equipment and machinery is subject to approval of KEH

3.1.3 Slope sides of excavations or trenches more than 4 feet deep in accordance with WISHA Chapter 296-155 WAC, Part N, Table N-1.

3.1.4 Do not store excavated or other material closer than 2 feet from edge of excavation unless barrier is erected to retain excavated materials. Store and maintain materials in manner that they are prevented from falling or sliding into excavation.

3.1.5 Wherever slopes of excavations will intersect existing underground lines or structures such as building foundations, underground piping, electrical ducts or direct buried electrical lines, install shoring or other means of support to prevent overstressing existing structure or underground lines or to prevent interrupting service to existing buildings.

#### 3.1.6 Footings and Foundations

3.1.6.1 Make excavations for footings to depth shown of the drawings or to further depth as necessary to provide undisturbed surface to receive footing. Make excavations to proper width with allowances made for forms and bracing. Make bottom of excavations compact, level, true, and free of loose material.

3.1.6.2 If over-excavation occurs where footings are designed to be placed on undisturbed earth, correct at time of placing concrete by extending concrete down to undisturbed earth.

#### 3.1.7 Trenches for Underground Piping and Conduit

3.1.7.1 Make excavations to line and grade shown on the drawings and wide enough to make connections. Excavate with near vertical sides from bottom of trench up to 1 foot above utility lines. Excavate trench deep enough to permit placement of compacted sand bedding, 4 inches minimum thickness, beneath lines except where excavation is in undisturbed sand which will serve as bedding go where lines are to be encased in concrete. Pare holes in trench bottoms for pipe couplings so pipe will bear full length of barrel or section.

3.1.7.2 Install shoring to hold materials and surcharge pressure for full depth of trench.

3.1.7.3 Keep trenches free of standing water when laying is in progress.

3.1.7.4 If over-excavation occurs, correct by placement of structural backfill.

### 3.1.8 Soils in Contaminated Zones

3.1.8.1 Salvage in situ stabilization material and reuse after backfilling and compacting.

3.1.8.2 In-place density tests will be conducted by KEH on in situ soils, using nuclear density gage, during excavation. Results of tests will be used by KEH for testing compaction of backfill.

3.1.9 Where stabilization is required, finish subgrade 3 inches below elevations shown on drawings.

## 3.2 INSTALLATION

### 3.2.1 Fill and Backfill

#### 3.2.1.1 General

a. Backfill Permit: Obtain approved backfill permit prior to start or fill.

b. Remove debris and organic matter from area to be filled or backfilled.

c. Use only select materials for fill or backfill. Keep materials free of frozen particles, lumps, organic matter and trash.

d. Do not place fill or backfill on frozen ground.

e. Filling or backfilling by sluicing or flooding with water will not be permitted.

f. Bring fill or backfill up evenly on sides of walls, structures and utility lines to avoid unbalanced loading.

g. Do not place fill or backfill against concrete structure or foundation wall less than 28 days after completion of structure or wall unless written permission from KEH Acceptance Inspector is obtained. Provide wall support, where noted on the drawings, before filling or backfilling.

#### 3.2.1.2 Structural

a. Before placement of fill or backfill, demonstrate to the KEH Acceptance Inspector by physical tests, the procedure for installation and compaction of soils will provide degree of compaction specified. Prepare



"Soil Compaction Procedure" Form KEH-0382, sample appended, in accordance with printed instructions. Forms will be furnished by KEH.

b. Place backfill in accordance with WSDOT M41-10, Section 2-03.3(14)C and approved procedure as follows:

- 1) Use Method C under foundations, slabs and pipelines.
- 2) Use Method B under pavements and roads, and within 5 feet of buildings, fences, other structures, or poles supporting electric lines or pipe.

c. Compaction control tests will be in accordance with WSDOT M41-10, Section 2-03.3(14)D.

d. Maximum lift - 8" loose depth.

#### 3.2.1.3 Underground piping and conduit trenches

a. Bedding placed beneath utility lines in trenches shall be material meeting the requirements of Paragraph 2.1.3.

b. Place and compact bedding in trench prepared according to subparagraph 3.1.7.1 before laying utility lines. Compact bedding as specified for structural backfill.

c. Place backfill over joints in underground pipes only after pressure testing of line has been completed.

d. Backfill under conduit and haunches of pipe, around sides, and at least 1 foot above top of pipe or conduit with bedding material. Place and compact material same as specified for structural backfill. Compact with care, to avoid misalignment of pipe and provide uniform bearing along barrel of pipe.

e. Backfill utility trenches from elevation 1 foot above top to grade with structural backfill as specified in subparagraph 3.2.1.2.

f. Do not allow heavy construction equipment to pass over buried lines until at least 2 feet of backfill has been placed over line or until bridging has been placed across trenching and approved by KEH.

#### 3.2.1.4 Soils in contaminated zones

a. Compact backfill by depositing soils in 8 inch layers and compacting to density equal to in situ density determined by tests made during excavation. Maintain uniformity of compaction throughout backfill.

b. Do not use soils containing rocks larger than 3 inches in greatest dimension for compacted backfill.

3.2.2 Plastic Sheet Marker: Place continuous over buried utility lines. Place marker tape directly over line and 1 foot below finish grade. Place marker over each outside pipe of multiple lines. Place intermediate

markers at maximum of 4 feet apart. Semi-metallic detectable tape shall be used above plastic pipe and non-metallic conduit.

### 3.2.3 Finish Grading and Stabilization

3.2.3.1 Rake area disturbed by work, remove surface stones larger than 6 inches and dispose of excess material and debris in accordance with KEH procedures.

3.2.3.2 Stabilize area disturbed by work with 3 inch course of gravel meeting the requirements of Paragraph 2.1.4. Finish stabilization course to elevations shown on the drawings.

### 3.3 FIELD QUALITY CONTROL

3.3.1 Soil Compaction Tests: Sampling and testing of compacted fill and backfill will be performed by KEH. Contractor to notify KEH Acceptance Inspector 4 hours in advance of compaction tests.

END OF SECTION

## SOIL COMPACTION PROCEDURE

A	Project Number	Project Info		Date				
	Contract Number	Procedure Number		Location of Demonstration				
	REQUIREMENTS				EQUIPMENT DEMONSTRATED			
	Applicable Spec./Org.				Type			
	Compaction Required %				Manufacturer			
	Maximum Lift Size				Model			
B	LABORATORY SOIL TEST RESULTS							
	<input type="checkbox"/> Non-granular Materials (WSDOT Test Method No. 609) Maximum Density _____ Moisture % _____		<input type="checkbox"/> Granular Materials (WSDOT Test Method No. 606-A) <input type="checkbox"/> Density Chart Attached		<input type="checkbox"/> In-Situ Density _____			
C	COMPACTION DEMONSTRATION TEST RESULTS							
	Formula for Percent Compaction: $\frac{\text{dry density}}{\text{Max Density}} \times 100 = \text{Percent Compaction}$							
	No. of Passes	Depth of Lift	Percent Moisture	Libert's Dry	Maximum Density	Percent Compaction	Accept	
							Reject	
Observations or Comments								
TEST METHOD USED FOR DEMONSTRATION <input type="checkbox"/> Nuclear Gauge (ASTM D2922 & D2917) <input type="checkbox"/> Other _____								
D	Contractor Representative						Date	
	Engineer/Constructor Inspector						Date	

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END OF SECTION

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## SECTION 02512

### HOT-LAID ASPHALTIC CONCRETE PAVING

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington State Department of Transportation (WSDOT)

M41-10-88

Standard Specifications for  
Road, Bridge, and Municipal  
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Laboratory Reports: Submit laboratory reports for following.

1.2.1.1 Asphalt: Showing that asphalt used in mix meets the requirements of AR-4000 in accordance with WSDOT M41-10, Section 9-02.1(4).

1.2.1.2 Asphalt concrete mix: Showing compliance with WSDOT M41-10, Sections 9-03.8(6). Include Rice density as established by WSDOT Method 705.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

2.1.1 Asphalt: Meeting the requirements of WSDOT M41-10, Sections 9-02.1(2) and 9-02.1(4). Grade of paving asphalt for use in asphaltic concrete mixture shall be AR-4000. Grade of liquid asphalt for prime coat shall be MC-250.

2.1.2 Aggregate: Class "B" meeting the requirements of WSDOT M41-10, Section 9-03.8(1), (2), (3)B.

2.1.3 Blending Sand: Meeting the requirements of WSDOT M41-10, Section 9-03.8(4).

2.1.4 Mineral Filler: Meeting the requirements of WSDOT M41-10, Section 9-03.8(5).

##### 2.2 MIXES

2.2.1 Proportioning of Asphalt Concrete Materials: Meeting the requirements of WSDOT M41-10, Section 9-03.8(6) Class "B" asphalt concrete.

#### PART 3 - EXECUTION

### 3.1 INSTALLATION

3.1.1 Construction: In accordance with following sections of WSDOT M41-10.

3.1.1.1 Asphalt mixing plants: Section 5-04.3(1).

3.1.1.2 Hauling equipment: Section 5-04.3(2).

3.1.1.3 Asphalt pavers: Section 5-04.3(3).

3.1.1.4 Rollers: Section 5-04.3(4).

3.1.1.5 Existing surface conditioning: Section 5-04.3(5).

3.1.1.6 Asphalt material heating: Section 5-04.3(6).

3.1.1.7 Aggregate preparation: Section 5-04.3(7).

3.1.1.8 Mixing: Section 5-04.3(8).

3.1.1.9 Spreading and finishing: Section 5.04.3(9).

3.1.1.10 Compaction: Section 5-04.3(10).

3.1.1.11 Joints: Section 5-04.3(11).

3.1.1.12 Samples: Section 5-04.3(12).

3.1.1.13 Surface smoothness: Section 5-04.3(13).

3.1.1.14 Heating-planing bituminous pavement: Section 5-04.3(14).

3.1.1.15 Weather limitations: Section 5-04.3(16).

3.1.1.16 Asphalt change in grade: Section 5-04.3(18).

### 3.2 FIELD QUALITY CONTROL

3.2.1 Sampling and testing of asphalt concrete pavement will be performed by KEH. Contractor to notify KEH Acceptance Inspector 4 hours in advance for witness of all paving.

### 3.3 PROTECTION

3.3.1 Traffic Control: Institute and maintain in accordance with WSDOT M41-10, Section 1-07.23, Subsections (1) through (4).

END OF SECTIONSECTION 02512

HOT-LAID ASPHALTIC CONCRETE PAVING

## PART 1 - GENERAL

### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington State Department of Transportation (WSDOT)

M41-10-88

Standard Specifications for  
Road, Bridge, and Municipal  
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Laboratory Reports: Submit laboratory reports for following.

1.2.1.1 Asphalt: Showing that asphalt used in mix meets the requirements of AR-4000W in accordance with WSDOT M41-10, Section 9-02.1(4).

1.2.1.2 Asphalt concrete mix: Showing compliance with WSDOT M41-10, Sections 9-03.8(6). Include Rice density as established by WSDOT Method 705.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Asphalt: Meeting the requirements of WSDOT M41-10, Sections 9-02.1(2) and 9-02.1(4). Grade of paving asphalt for use in asphaltic concrete mixture shall be AR-4000. Grade of liquid asphalt for prime coat shall be MC-250.

2.1.2 Aggregate: Class "B" meeting the requirements of WSDOT M41-10, Section 9-03.8(1), (2), (3)B.

2.1.3 Blending Sand: Meeting the requirements of WSDOT M41-10, Section 9-03.8(4).

2.1.4 Mineral Filler: Meeting the requirements of WSDOT M41-10, Section 9-03.8(5).

### 2.2 MIXES

2.2.1 Proportioning of Asphalt Concrete Materials: Meeting the requirements of WSDOT M41-10, Section 9-03.8(6) Class "B" asphalt concrete.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

3.1.1 Construction: In accordance with following sections of WSDOT M41-10.

- 3.1.1.1 Asphalt mixing plants: Section 5-04.3(1).
- 3.1.1.2 Hauling equipment: Section 5-04.3(2).
- 3.1.1.3 Asphalt pavers: Section 5-04.3(3).
- 3.1.1.4 Rollers: Section 5-04.3(4).
- 3.1.1.5 Existing surface conditioning: Section 5-04.3(5).
- 3.1.1.6 Asphalt material heating: Section 5-04.3(6).
- 3.1.1.7 Aggregate preparation: Section 5-04.3(7).
- 3.1.1.8 Mixing: Section 5-04.3(8).
- 3.1.1.9 Spreading and finishing: Section 5.04.3(9).
- 3.1.1.10 Compaction: Section 5-04.3(10).
- 3.1.1.11 Joints: Section 5-04.3(11).
- 3.1.1.12 Samples: Section 5-04.3(12).
- 3.1.1.13 Surface smoothness: Section 5-04.3(13).
- 3.1.1.14 Heating-planing bituminous pavement: Section 5-04.3(14).
- 3.1.1.15 Weather limitations: Section 5-04.3(16).
- 3.1.1.16 Asphalt change in grade: Section 5-04.3(18).

### 3.2 FIELD QUALITY CONTROL

3.2.1 Sampling and testing of asphalt concrete pavement will be performed by KEH. Contractor to notify KEH Acceptance Inspector 4 hours in advance for witness of all paving.

### 3.3 PROTECTION

3.3.1 Traffic Control: Institute and maintain in accordance with WSDOT M41-10, Section 1-07.23, Subsections (1) through (4).

END OF SECTION

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American Concrete Institute (ACI)

ACI 301-89                      Specifications for Structural  
Concrete for Buildings

ACI 306.1-87                  Standard Specification for Cold  
Weather Concreting

##### 1.1.1.2 American Society for Testing and Materials (ASTM)

A 185-90                      Standard Specification for  
Steel Welded Wire Fabric,  
Plain, for Concrete  
Reinforcement

A 615-90                      Standard Specification for  
Deformed and Plain Billet-Steel  
Bars for Concrete Reinforcement

A 853-90                      Standard Specification for  
Steel Wire, Carbon, for General  
Use

C 33-90                      Standard Specification for  
Concrete Aggregates

C 94-90                      Standard Specification for  
Ready-Mixed Concrete

C 150-89                      Standard Specification for  
Portland Cement

C 260-86                      Standard Specification for  
Air-Entraining Admixtures for  
Concrete

C 494-86                      Standard Specification for  
Chemical Admixtures for  
Concrete



1.1.1.3 Washington State Department of Transportation (WSDOT)

M41-10-91

Standard Specification for  
Road, Bridge, and Municipal  
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Reinforcing Steel Fabricator Drawings: Submit complete reinforcing fabrication and placing drawings based on block diagram in accordance with ACI 301, Section 5.1, including splices not shown on the drawings.

1.2.2 Concrete Materials, Mix Design, and Mix Proportions: Submit concrete materials, mix design, and mix proportions in accordance with ACI 301, Sections 3.8 and 16.7.3. Define each material to be used in concrete and state amount, by weight, to be utilized per cubic yard of plastic mix.

1.2.3 Material Test Reports for Reinforcing steel: Submit material test reports for reinforcing steel.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Concrete

2.1.1.1 Cement: ASTM C 150, Type II (Low Alkali)

2.1.1.2 Aggregates: ASTM C 33, maximum size 1-1/2 inch

2.1.1.3 Air-entraining admixture: Meeting the requirements of ASTM C 260. Similar to Sika Chemical Company "SIKA AER", Chem-Masters Corp "Adz-Air", or Protex Industries "AES".

2.1.1.4 Water reducing agents: Aqueous solution of calcium salts of lignin sulfonic acid meeting the requirements of ASTM C 494, Type A.

2.1.1.5 Properties

- a. Minimum allowable compressive strength: 4000 psi at 28 days.
- b. Slump: 4 inch in accordance with ACI 301, Section 3.5.
- c. Air content: In accordance with ACI 301, Table 3.4.1.
- d. Proportions: In accordance with ACI 301, Sections 3.8 and 3.9.

2.1.1.6 Mixing: In accordance with ASTM C 94.

2.1.1.7 Delivery: In accordance with ASTM C 94.

2.1.2 Reinforcing Steel

2.1.2.1 Steel bars: ASTM A 615, deformed, Grade 60.

2.1.2.2 Welded wire fabric: ASTM A 185.

2.1.2.3 Tie wire: Carbon steel, 0.062 inch minimum, annealed, in accordance with ASTM A 853.

### 2.1.3 Joint Materials

2.1.3.1 Epoxy resin: Meeting the requirements of WSDOT M41-10, Section 9-26, Type II, Grade 2, Class B or C. Similar to EAS8 Class A by QCM Company, Concresive 1001 LPL by Adhesive Engineering, or Probond 822 by Protex.

2.1.3.2 Expansion joint filler: See Section 07900.

2.1.3.3 Sealant: See Type II, Section 07900.

2.1.4 Nonshrink Grout: Nonmetallic type similar to "Five Star Grout" by US Grout Corp, "Sik Grout 212" by Sika Corp, or "Masterflow 713" by Master Builders.

2.1.5 Forms: Wood, steel, plywood, or similar to Masonite Corporation "Concrete Form Presdwood", as required for various specified finishes.

2.1.6 Form Coating Materials: Similar to Magic Kote by Symons Corp, Form Shield by AC Horn Inc, or Burke Release #1 by the Burke Company.

2.1.7 Waterstops: Virgin polyvinyl chloride plastic compound with a tensile strength greater than 2000 psi, similar to Paul Murphy Plastics Company Wirestop Part No. CR-6316 Waterstop.

2.1.8 Vapor Barrier: 10 mil polyvinyl chloride sheeting.

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Form Construction

3.1.1.1 Install formwork in accordance with ACI 301, Section 4.2 and approved submittals. Interior shape and rigidity shall be such that finished concrete will meet the requirements of the Drawings within tolerances specified in ACI 301, Table 4.3.1.

3.1.1.2 Prepare form surfaces in accordance with ACI 301, Section 4.4 using specified form coating materials, or as described in subparagraph 3.1.1.3.

3.1.1.3 Forms for surfaces which will be permanently concealed from view may be saturated with water before placing concrete instead of other treatment, except in freezing weather forms shall be treated with oil or stearate.

3.1.1.4 Clean forms of foreign material before placing concrete.

## 3.2 INSTALLATION

### 3.2.1 Reinforcing Steel

3.2.1.1 Fabricate bars accurately to dimensions shown on the drawings, within tolerances shown in ACI 301, Section 5.6.

3.2.1.2 Tag in accordance with bar list.

3.2.1.3 Place as shown on approved submittals within tolerances specified in ACI 301, Sections 5.6 and 5.7.

3.2.1.4 Tie to prevent displacement during placement of concrete.

3.2.1.5 Do not force into concrete after initial set has started.

3.2.1.6 Place with dimension of concrete protection equal to minimum given in ACI 301, Section 5.7, except where shown otherwise on the drawings.

3.2.1.7 Place welded wire fabric on chairs and lap 2 mesh at splices. Tie splices with wire.

### 3.2.2 Concrete

3.2.2.1 Before ordering, obtain approval of required submittals.

3.2.2.2 Before batching, obtain approval of formwork and reinforcement by KEH.

3.2.2.3 Before placing

a. Obtain approval of "Pour Slip" by KEH. "Pour Slip" shall include appropriate reference to specific portion of structure to be placed, maximum size of coarse aggregate, design strength, admixture, and slump. "Pour Slip" forms can be obtained from KEH.

b. For each truck load, deliver "Trip Ticket" to KEH. "Trip Ticket" shall contain information listed in ASTM C 94, subparagraphs 16.1.1 through 16.1.10, and include water/cement ratio.

3.2.2.4 Place in accordance with ACI 301, Sections 8.1, 8.2, and 8.3. Do not drop more than 5 feet. Insert vibrator, vertically if possible, into concrete and reach small distance into concrete in next lower layer. Do not insert vibrators into lower courses that have reached initial set. Take care to avoid allowing head of vibrator to come in contact with forms, reinforcement, or embedded items.

3.2.2.5 Temper only as permitted in ACI 301, Section 7.5.

3.2.2.6 Place nonshrink grout where shown on the drawings and in accordance with manufacturer's recommendations.

3.2.2.7 Weather conditions: Protect concrete during placement in accordance with ACI 301, Section 8.4. Cold weather concreting shall be in accordance with ACI 306.1, Section 1.5.1.

3.2.2.8 Construction joints: Make in accordance with ACI 301, Section 6.1, and as detailed on the drawings. Coat joints with epoxy resin, where shown on the drawings, in accordance with manufacturer's recommendations.

3.2.2.9 Embedded items: Install in accordance with ACI 301, Sections 6.4 and 6.5.

3.2.2.10 Expansion joints: Make in accordance with ACI 301, Section 6.2 and details on the drawings.

3.2.2.11 Waterstops: Fasten every 12 inches, both sides, to reinforcing bars. Heat fuse all field splices per manufacturer's recommendations.

3.2.2.12 Vapor barrier: Place on or against firm surfaces free of frost, ice and free water. Do not place until required compaction has been obtained. Lap joints 6 inch minimum. Turn up at perimeter and seal with sealant against concrete surface.

3.2.2.13 Consolidation: Consolidate concrete slabs in accordance with ACI 301, Section 11.6.

### 3.2.3 Concrete Repair and Form Removal

3.2.3.1 Form removal: Remove in accordance with ACI 301, Section 4.5.

3.2.3.2 Cut back form ties and examine concrete surfaces for defects. Repair only after permission for patching is given by KEH.

3.2.3.3 Place concrete repair mortar within one hour after mixing. Do not retemper mortar.

3.2.3.4 Surface defect repair: Repair in accordance with ACI 301, Sections 9.1, 9.2 and 9.3. Cure concrete repairs same as new concrete.

### 3.2.4 Concrete Finishes and Tolerances

3.2.4.1 Formed surfaces: Start finishing following concrete repair and complete within 96 hours after forms have been removed. Finish in accordance with sections of ACI 301 noted below.

- |   |                |
|---|----------------|
| a. Surfaces exposed to earth backfill             | Section 10.2.1 |
| b. Interior surfaces                              | Section 10.2.2 |
| c. Exterior surfaces exposed to weather           | Section 10.2.2 |
| d. Related unformed surfaces                      | Section 10.5   |
| e. Surfaces to receive special protective coating | Section 10.3.2 |

3.2.4.2 Unformed surfaces: Finish in accordance with sections of ACI 301 noted below.

- |   |                |
|---|----------------|
| a. Interior floors                        | Section 11.7.3 |
| b. Exterior equipment slabs               | Section 11.7.3 |
| c. Exterior slabs subject to foot traffic | Section 11.7.4 |

### 3.3 FIELD QUALITY CONTROL

3.3.1 Concrete Testing: Sampling and testing of concrete will be the responsibility of KEH. Concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8.

3.3.2 Anchor Bolt Inspection: Anchor bolt inspection will be the responsibility of KEH. Anchor bolt inspection will be in accordance with the UBC.

3.3.2 Anchor Bolt Inspection: Anchor bolt inspection will be the responsibility of KEH. Anchor bolt inspection will be in accordance with the MBC.

### 3.4 CURING AND PROTECTION

#### 3.4.1 Curing

3.4.1.1 Cure concrete in accordance with ACI 301, Section 12.2. Clear curing compounds shall be tinted or applied surfaces marked to delineate extent of spraying.

3.4.1.2 Do not use curing compound on concrete surfaces to receive flooring or special protective coating.

#### 3.4.2 Protection

3.4.2.1 Protect concrete during extreme weather conditions in accordance with ACI 301, Section 12.3.

3.4.2.2 Protect concrete from mechanical injury in accordance with ACI 301, Section 12.4.

END OF SECTION

**SECTION 05120**  
**STRUCTURAL STEEL**

**PART 1 - GENERAL**

**1.1 REFERENCES**

**1.1.1 Reference Standards and Specifications:** The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

**1.1.1.1 American Institute of Steel Construction (AISC)**

AISC M016-1989	Allowable Stress Design (ASD) Manual of Steel Construction, 9th Edition
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AISC S326 - June, 1989	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
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AISC S329 - November, 1985	Specification for Structural Joints Using ASTM A 325 or A 490 Bolts
-------------------------------	---

**1.1.1.2 American Society of Mechanical Engineers (ASME)**

1989 Edition, w/Addenda through Dec 1989	ASME Boiler and Pressure Vessel Code
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Section IX	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
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**1.1.1.3 American Society for Testing and Materials (ASTM)**

A 36-90	Standard Specification for Structural Steel
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A 53-90a	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
----------	--

A 108-90a	Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
-----------	--

A 276-90a	Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes
-----------	---



1.4.2 Provide setting drawings, templates, and directions for installation of anchor bolts and other devices to be embedded.

1.4.3 Store structural steel members at site above ground on platforms, skids or other supports.

1.4.4 Protect steel from corrosion.

1.4.5 Store materials in weathertight and dry place, until ready for use in work.

1.4.6 Store packaged materials in original unbroken package or container.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Rolled Steel Shapes and Plates: ASTM A 36.

2.1.2 Steel Bars and Rods: ASTM A 108, minimum yield 36,000 psi, maximum carbon content 0.35 percent.

2.1.3 Stainless Steel Grating: ASTM 276, Type 304L, cold finish, fully annealed, size shown on the drawings.

2.1.4 Steel Tubing: ASTM A 500, Grade B, or ASTM A 501.

2.1.5 Steel Pipe: ASTM A 53, Type E or S, Grade B.

2.1.6 Steel Grating: ASTM A36, Galvanized finish to G90 weight. Sizes shown on drawing.

2.1.7 Fasteners

2.1.7.1 Fasteners shall have Class 2 fit.

2.1.7.2 Bolts

a. For general application: ASTM A 307, Grade A or B.

b. For permanent structural steel column and beam connections:  
ASTM A 325, Type 1 or 2.

2.1.7.3 Nuts

a. For ASTM A 307 bolts: ASTM A 563, Grade A, heavy hex.

b. For ASTM A 325 bolts: ASTM A 563, Grade C, plain, heavy hex.

2.1.7.4 Washers for ASTM A 325 bolts: ASTM F 436, circular washers.

2.1.7.5 Expansion Anchors: Kwik-Bolt II manufactured by Hilti Fastening Systems or Red Head Wedge Anchor manufactured by Phillips Drill Company.



2.1.7.6 Weld studs: Nelson Stud Welding Company type H4L.

2.1.8 Nonshrink Grout: See Section 03300.

2.1.9 Paint: See Section 09900.

## 2.2 FABRICATION

2.2.1 Fabricate structural steel for close fit, with erection holes aligned within tolerances given in AISC S326.

2.2.2 Fabricate beam-to-column and beam-to-beam connections in accordance with AISC Manual of Steel Construction, Part 4 and Table I, or Table I in combination with Table III. Connections shall be high-strength-bolted or welded unless otherwise noted on the drawings.

### 2.2.3 Shop Painting

2.2.3.1 Prepare and prime coat steel in accordance with Section 09900.

2.2.3.2 Do not apply primer to surfaces within 3 inches of welds before welding.

2.2.3.3 Do not apply primer to contact surfaces within friction type joints.

## PART 3 - EXECUTION

### 3.1 ERECTION

3.1.1 Erect structural steel in accordance with AISC S326, except welding shall be in accordance with this Section.

3.1.2 Perform welding in accordance with AWS D1.1.

3.1.3 One-sided or other type of eccentric connections will not be permitted except where shown on the drawings.

3.1.4 Fabricate welded connections in accordance with Table IV, Part 4, of AISC Manual of Steel Construction.

3.1.5 Prepare ends of columns square at splices and base plates.

3.1.6 Install weld studs in accordance with manufacturer's recommendations.

3.1.7 Use E70XX electrodes for welding.

3.1.8 Do not use oxy-fuel cutting for correcting fabrication errors on major members in structural framing. Holes shall not be made or enlarged by oxy-fuel cutting. Oxy-fuel cutting will be permitted only on minor members and only after permission of KEH Acceptance Inspector is obtained.

3.1.9 Contact surfaces within friction-type joints shall be free of oil, paint, and other foreign materials.

3.1.10 Do not make holes in framing members for supporting equipment, unless shown on the drawings, without approval from KEH Acceptance Inspector.

3.1.11 Drift pins may be used in connections to bring together several parts, but not in a manner which will enlarge bolt holes or distort or damage framing.

3.1.12 Connections using high strength bolts fasteners shall meet the requirements of AISC S329.

3.1.13 Use high strength bolts for connections in structural framing. Tighten nuts by use of torque wrenches or by "turn-of-the-nut" method in accordance with AISC specifications.

3.1.14 Install expansion anchors in accordance with UBC requirements.

3.1.15 Grouting

3.1.15.1 Grout-in column base plates, where shown on the drawings, with specified grout mixed in accordance with manufacturer's directions.

a. Before grouting, clean concrete and masonry bearing surfaces and roughen to improve bond. Clean bottom surfaces of base plates.

b. Pack grout solidly between bearing surfaces and base plates to ensure no voids remain. Bevel exposed surfaces.

3.1.16 Touch-up: After erected steel has been approved, clean and paint connections with primer. Touch-up shop prime coat where damaged. Prime and touch-up with same primer used for shop coat.

### 3.2 FIELD QUALITY CONTROL

3.2.1 Nondestructive Weld Examination (NDE): Contractor notify KEH Acceptance Inspector 4 hours in advance perform visual examination of final weld configuration in accordance with AWS D1.1, paragraph 6.5.5 and paragraph 8.15.

3.2.2 Anchor bolts and anchorages inspection: Anchor bolt inspection will be the responsibility of KEH.

END OF SECTION

**SECTION 05500**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 REFERENCES**

**1.1.1 Reference Standards and Specifications:** The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

**1.1.1.1 American Society of Mechanical Engineers (ASME)**

1986 Edition, w/Addenda  
through Dec 1987

ASME Boiler and Pressure Vessel  
Code

Section IX

Qualification Standard for  
Welding and Brazing Procedures,  
Welders, Brazers, and Welding  
and Brazing Operators

**1.1.1.2 American Society for Testing and Materials (ASTM)**

A 36-90

Standard Specification for  
Structural Steel

A 53-90a

Standard Specification for  
Pipe, Steel, Black and  
Hot-Dipped, Zinc-Coated Welded  
and Seamless

A 123-89a

Standard Specification for Zinc  
(Hot-Galvanized) Coatings on  
Iron and Steel Products

A 307-90

Standard Specification for  
Carbon Steel Bolts and Studs,  
60 000 PSI Tensile Strength

A 500-90

Standard Specification for  
Cold-Formed Welded and Seamless  
Carbon Steel Structural Tubing  
in Rounds and Shapes

A 536-84

Standard Specification for  
Ductile Iron Castings

A 563-90

Standard Specification for

- Carbon and Alloy Steel Nuts
- A 786-89      Standard Specification for Rolled Steel Floor Plates
- F 436-90      Standard Specification for Hardened Steel Washers
- 1.1.1.3      American Welding Society (AWS)
  - AWS D1.1-88      Structural Welding Code - Steel
- 1.1.1.4      Federal Specifications (FS)
  - RR-G-661E      Grating, Metal, Bar Type (Floor, Except For Naval Vessels)
- 1.1.1.5      Military Specifications (MS)
  - MIL-F-20138C      Floor Plate, Corrosion Resistant Steel, Rolled
- 1.2      SUBMITTALS: Refer to Section 01300 for submittal procedures.
- 1.2.1      Fabricator Drawings
  - 1.2.1.1      For metal fabrications not shown on manufacturer's data sheets: Submit drawings and bill of materials. Include plans, elevations, details, sections and connections. Show thickness, type, grade, class of metal, fasteners, anchorage and accessory items where applicable.
  - 1.2.1.2      For gratings
    - a.      Submit drawings showing overall dimensions, details, and direction of bearing bars in accordance with the drawings. Include cutouts and banding of grating around obstructions.
    - b.      Submit load/deflection tables to verify conformity with design values shown on the drawings.
  - 1.2.2      Manufacturer's Data: Submit copies of manufacturer's specifications, dimensioned diagrams, anchor details and installation instructions for manufactured items.
- 1.3      QUALITY ASSURANCE
  - 1.3.1      Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding structural steel shall have been qualified in accordance with AWS D1.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.2 Maintain file of welding procedure specifications, procedure qualification records and welder performance qualification test results at site for review.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Deliver metal fabrications to project at time convenient for installation. If exposed to inclement weather, protect fabrications with paper, plastic or other weatherproof covering and store off ground.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

2.1.1 Rolled Steel Shapes, Plates and Bars: ASTM A 36.

2.1.2 Steel Pipe: ASTM A 53 (black), standard weight, Schedule 40.

2.1.3 Steel Tubing: ASTM A 500, Grade B.

2.1.4 Fasteners

2.1.4.1 Bolts: ASTM A 307, Grade A

2.1.4.2 Nuts: ASTM A 563, Grade A, heavy hex.

2.1.4.3 Washers: ASTM F 436, circular washers.

2.1.4.4 Expansion anchors: Kwik-Bolt II manufactured by Hilti Fastening Systems or Red Head Wedge Anchor manufactured by Phillips Drill Company.

2.1.4.5 Weld studs: Nelson Stud Welding Company Type (CPL), (H4L), (S3L).

2.1.5 Ductile Iron Construction Castings: ASTM A 536, Grade 65-45-12, heavy duty, capable of supporting 16000 lb wheel load.

2.1.6 Diamond Tread Floor Plate

2.1.6.1 Steel: Meeting the requirements of ASTM A 786, using ASTM A 36 material.

2.1.7 Metal Grating: Meeting the requirements of FS RR-G-661, Type I, Class 1, Material S, hot-dip galvanized. Grating shall be plain surface type

with end banding bars, size shown on the drawings. Provide manufacturer's standard clips for attachment to framing.

2.1.8            Nonshrink Grout: See Section 03300.

2.1.9            Paint: See Section 09900.

2.1.10           Isolating Tape: No. 162.03 Elastic Compound Tape by Inmont Corporation, or Kling-Felt No. 213 by Products Research and Chemical Corp.

2.1.11           Supports: Interchangeable channels, channel spring nuts, and bolts; Unistrut by Unistrut Building Systems, B-Line by B-Line Systems, Inc, or Ostrut by Michigan Hanger Co.

2.1.11.1        Channels: 1-5/8 inches wide and manufacturer's part numbers for depths listed below.

<u>Manufacturer:13/16 inch :1-3/8 inches :1-5/8 inches :3-1/4 inches</u>								
Unistrut	:	P4100	:	P3000	:	P1000	:	P5000
B-Line	:	B-54	:	B-32	:	B-22	:	B-11
Ostrut	:	C-14	:	B-12	:	A-12	:	E-12

2.1.11.2        Channel spring nuts: Manufacturer's standard.

2.1.11.3        Bolts for use with channel spring nuts: Manufacturer's standard.

2.1.12           Support Clamps: For rigid steel conduit; Unistrut, B-Line, or Ostrut.

## 2.2            FABRICATION

### 2.2.1           General

2.2.1.1        Verify measurements and take field measurements necessary before fabrication. Provide miscellaneous bolts and anchors, supports, braces and connections necessary for completion of metal fabrications. Cut, reinforce, drill and tap metal fabrications shown to receive finish hardware and similar items. Weld or bolt connections as shown on the drawings.

2.2.1.2        Workmanship: Form metal fabrications to shape and size, with sharp lines, angles, and true curves. Drilling and punching shall produce clean, true lines and surfaces. Execute and finish work in accordance with fabrication drawings.

## PART 3 - EXECUTION

### 3.1 INSPECTION

3.1.1 Examine areas where metal fabrications are to be installed and notify KEH Acceptance Inspector in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner compatible with requirements for installation. Furnish setting drawings, diagrams, templates, for to be embedded in concrete. Coordinate with KEH Construction Field Engineer for delivery of items to site.

3.1.2 Contractor to notify KEH Acceptance Inspector four hours in advance of welding in accordance with AWS D1.1, paragraph 6.5.5 and paragraph 8.15.

### 3.2 INSTALLATION

3.1.2 Anchor bolts and anchorages inspection: Anchor bolt inspection will be the responsibility of KEH. Anchor bolts and anchorage will be in accordance with the with the UBC.

3.2.1 Install metal fabrications plumb, level or as shown on the drawings.

3.2.2 Make field connections as neatly as possible with joints flush and smooth. Grind smooth exposed field welds and polish before field painting. Repair welds in galvanized work with 2 coats of zinc-rich coating.

3.2.3 Where handrail posts are set in pipe sleeves, install with nonshrink grout mixed in accordance with manufacturer's directions.

3.2.4 Torque bolts used with channel spring nuts in support channels and clamps as follows.

<u>Bolt size, inches</u>	<u>Torque, ft-lb</u>
1/4	6
5/16	11
3/8	19
1/2	50

3.2.5 After installation has been approved, clean and paint connections with primer. Touch-up shop prime coat wherever damaged. Repair breaks in galvanized coatings with zinc-rich coating.

END OF SECTION

3.1.2.2 If application is with adhesive, verify that fins and projections left after removal of forms have been removed from concrete surfaces. Clean dirt, wax, or oily film from concrete.

3.1.2.3 Install either by placing in forms before concrete placement, or by applying to completed foundation wall with adhesive recommended by insulation manufacturer.

END OF SECTION



## SECTION 08100

### METAL DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American Society for Testing and Materials (ASTM)

A 366-85 Standard Specification for  
Steel, Sheet, Carbon,  
Cold-Rolled Commercial Quality

A 569-85 Standard Specification for  
Steel, Carbon (0.15 Maximum,  
Percent), Hot-Rolled Sheet and  
Strip, Commercial Quality

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Fabricator Drawings: Submit drawings showing size, elevations and location of each door and frame. Include location and details of hardware reinforcement, and frame anchors.

##### 1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Deliver to site in undamaged condition.

1.3.2 Store above ground and under cover.

1.3.3 Clean abraded or rusty areas and touch up with primer as per manufacturer's requirements.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

2.1.1 Hollow Metal Doors: Full-flush type doors, 1-3/4 inch thick, with no seams or joints on face.

2.1.1.1 See drawings for types, sizes, and fire rating labels.

2.1.1.2 Fabricate from 0.0478 inch minimum annealed and leveled ASTM A 366 or ASTM A 569 steel.

- 2.1.1.3 Fabricate with stiles and rails, 0.0598 inch minimum.
- 2.1.1.4 Doors reinforced with 1 of following.
  - a. Steel members welded in place with spaces filled with insulation.
  - b. Water resistant honeycomb core bonded to both faces.
- 2.1.1.5 Fabricate with 1/8 inch maximum clearance from frames.
- 2.1.1.6 Doors prepared for lockset, and mortised for template hinges.
- 2.1.1.7 Reinforce for hinges with 0.1345 inch minimum steel, for closers with 0.1046 inch minimum steel, and for locks with 0.0747 inch minimum steel. Reinforcement drilled and tapped as required for attachment of hardware.
- 2.1.1.8 Surface welds ground smooth.
- 2.1.1.9 Glazing stop on exterior side of doors shall be nonremovable.
- 2.1.2 Pressed Metal Frames
  - 2.1.2.1 See drawings for profiles, dimensions, and fire rating labels.
  - 2.1.2.2 Fabricate from 0.0598 inch annealed and leveled ASTM A 366 or ASTM A 569 steel.
  - 2.1.2.3 Corners mitered, welded and ground smooth.
  - 2.1.2.4 Three 0.0478 inch wall anchors and 1 floor anchor for each jamb.
  - 2.1.2.5 Temporary spreader attached to bottom of each frame.
  - 2.1.2.6 Reinforce for hinges with 0.1345 inch minimum steel, and for strikes and closers with 0.1046 inch minimum steel. Reinforcement drilled and tapped as required for attachment of hardware.
  - 2.1.2.7 Plaster guards installed at hardware cut-outs.
- 2.1.3 Shop Finish: Doors and frames bonderized and painted with 1 coat of manufacturer's standard, baked-on, rust inhibitive primer. Primer containing lead will not be acceptable.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

3.1.1 Leave temporary spreaders in place until frames are attached to wall framing. For frames over 4 feet wide, provide temporary intermediate vertical support.

3.1.2 Install frames with jambs plumb and head level.

3.1.3 Attach frames to wall framing. Align anchors with hinges and door strike.

3.1.4 Install doors in conjunction with application of hardware, and with uniform clearance at head and jambs. Leave in smooth operating condition.

END OF SECTION

## SECTION 08710

### DOOR HARDWARE

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA)

ANSI A156.1-1988	American National Standard for Butts and Hinges
ANSI A156.2-1989	American National Standard for Bored and Preassembled Locks and Latches
ANSI A156.3-1989	American National Standard for Exit Devices
ANSI A156.4-1986	American National Standard for Door Controls--Closers
ANSI A156.6-1986	American National Standard for Architectural Door Trim
ANSI A156.16-1989	American National Standard for Auxiliary Hardware

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Hardware List: Submit complete hardware list. List hardware for each door separately under door number and hardware requirement.

##### 1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Packing and Marking: Pack each item of hardware separately, with necessary fasteners and instructions. Mark each item with hardware number shown in hardware list.

1.3.2 Protect hardware from damage before, during, and after installation.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

**2.1.1 Specific Requirements:** See hardware schedule at end of this Section.

**2.1.2 Manufacturers Catalog Numbers:** Catalog numbers in hardware schedule refer to following manufacturers.

**2.1.2.1 Door hinges:** ANSI A156.1, types and sizes shown in schedule, with nonremovable pins on exterior doors; Stanley, 4 1/2" x 4 1/2".

**2.1.2.2 Locksets:** ANSI F12, Series 9500, Grade 1 type shown in schedule; Corbin.

**2.1.2.3 Exit devices:** ANSI A156.3, type shown in schedule; Van Duprin.

**2.1.2.4 Door closers:** ANSI A156.4, type and size shown in schedule; Norton.

**2.1.2.5 Weatherstrip and thresholds:** ANSI A156.6, type shown in schedule; Pemko.

**2.1.2.6 Door Stops:** ANSI A156.16, type shown in schedule; Glynn-Johnson, Ives.

**2.1.2.7 Lock cylinders**

a. Furnish 5 pin tumbler cylinders with Corbin 59A1 keyway for each lockset. Key locks to match existing master-key system as directed by KEH Quality Services.

**2.1.3 Fasteners:** Furnish necessary screws, bolts, or other fasteners of suitable size and type to anchor hardware in position. Match hardware finish. Furnish with expansion shields, toggle bolts, or other appropriate anchors.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

**3.1.1 Verify installation and be responsible for fit of hardware in location specified.**

### 3.2 ADJUSTING AND CLEANING

3.2.1 Remove protective coverings and clean hardware before completion of project. Leave hardware in smooth operating condition. Deliver keys to Field Contract Engineer.

### 3.3 HARDWARE SCHEDULE

Hardware Group No.	Hardware	Quantity	Hardware Type	ANSI A156.18 Finish
1	Hinges	1-1/2 Pr	CB 1961, 630 NRP	US26D
	Lockset	1	8789L2-9549	
			59 C 2-G-Keyway 630	US26D
			Curved lip strike	
	Closer	1	CLP 7500 T	US26D
	Threshold	1	277 AR	
	Weatherstrip	1 Set	316 AV	
2	Hinges	1-1/2 Pr	CB 1961, 630 NRP	US26D
	Exit Device	1	99 NL	US26D
	Closer	1	CLP 7500 T	US26D
	Threshold	1	277 AR	
	Weatherstrip	1 Set	316 AV	
3	Padlock	1 Each	Hardware by door manufacturer	
4	Hinges	1-1/2 Pr	CB 1961, 630	US26D
	Lockset	1	8789 L 2-9549	US26D
			59 C 2-6-Keyway 630	
			Curved lip strike	
	Threshold	1	277 AR	
	Weatherstrip	1 Set	316 AV	
	Door Stop	1	GJ FB 19	

END OF SECTION

**SECTION 09510  
SUSPENDED ACOUSTICAL CEILING**

**PART 1 - GENERAL**

**1.1 REFERENCES**

**1.1.1 Reference Standards and Specifications:** The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

**1.1.1.1 American Society for Testing and Materials (ASTM)**

A 641-89	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
C 635-86	Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings
C 636-86	Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay In Panels
D 1779-65(1983)	Standard Specification for Adhesive for Acoustical Materials
E 1264-90	Standard Classification for Acoustical Ceiling Products

**1.1.1.2 International Conference of Building Officials (ICBO)**

UBC Standard 47-18 1988 Edition	Uniform Building Code (UBC) Standards
Report No. 4071	Seismic Connection Details for Gypsum Wall Board Nonbearing Partitions and Suspended Ceilings

**1.2 SUBMITTALS:** Refer to Section 01300 for submittal procedures.

1.2.1 Installation Drawings: Submit drawings showing, as minimum, the following.

1.2.1.1 Reflected ceiling plans and elevations of wall: Scale at least 1/4 inch equals 1 foot. Show pattern of acoustical units and penetrations.

1.2.1.2 Details at changes in elevation, penetrations and interfaces between acoustical system and adjacent materials.

1.2.1.3 Hanger spacing.

1.2.2 Manufacturer's Data: Submit manufacturer's data for each type and pattern of acoustical units and each item used in suspension system.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Suspension System: Exposed 2 way tee grid for lay-in acoustical panels.

2.1.1.1 Fiberglass reinforced polyester ceiling grid system. Similar to Kemlite Sanigrid.

2.1.1.2 Classification: Heavy duty meeting the requirements of ASTM C 635.

2.1.1.3 Exposed finish: Low sheen white.

2.1.1.4 Main tee runners: FRP Web design with rectangular bulb, 1-1/2 inch deep, 15/16 inch exposed flange with rolled cap, and integral reversible splice.

2.1.1.5 Cross tee: FRP Web design with rectangular bulb, (1) (1-1/2) inch deep, 15/16 inch exposed flange with rolled cap, web end tabs extending to form positive interlock with main runners and flange extended and offset.

2.1.1.6 Wall moldings: 1-1/2 inch deep FRP channel with 15/16 inch exposed face, or nominal 1 by 1 inch angle.

2.1.1.7 Hold down clips: Manufacturer's standard.

2.1.2 Hanger Wire: Galvanized steel wire meeting the requirements of ASTM A 641, Class 1 annealed, and at least 12 gage.

2.1.3 Adhesive: Meeting the requirements of ASTM D 1779.

2.1.4 Acoustical Units



2.1.4.1 Lay in panels: Meeting the requirements of ASTM E 1264, Type III, Class A. Similar to Kemlite Fire X Glassbond.

a. Size: 24 by 48 by 5/8 inch.

b. Finish: Factory applied washable white fiberglass with light reflectance of over 75 percent.

c. Noise reduction coefficient (NCR) range: 0.60 - 0.70 mechanically supported.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

3.1.1 Do not start work until adjacent surfaces have been completed, area is broom clean and building has been closed in and heated to at least 50 F.

#### 3.2 PREPARATION

3.2.1 Lay out so pieces less than 1/2 unit wide or long are avoided.

#### 3.3 INSTALLATION

##### 3.3.1 Suspension System

3.3.1.1 Install in accordance with ASTM C 636.

3.3.1.2 Where above-ceiling equipment prevents installation of hanger wire from structure to ceiling, support ceiling on 1-1/2 inch cold-rolled runner channels hung from structure.

3.3.1.3 Install intermediate hanger wire at cross tees spanning more than 48 inches.

3.3.1.4 Install hanger wires supporting tees at corners of lighting fixtures.

3.3.1.5 Fasten wall moldings 32 inches on center, maximum.

3.3.1.6 Add vertical strut member in conformance with ICBO Report No. 4071 at each braced point to resist vertical component of force in splayed bracing wires.

3.3.1.7 Provide splay wires not more than 4 feet from each perimeter wall or at the edge of vertical ceiling offsets in accordance with UBC Standard 47-18.

3.3.2 Acoustical Units

3.3.2.1 Install acoustical units in straight, level and true lines.

3.3.2.2 Install accessible hold down clips for all panels.

3.4 CLEANING

3.4.1 Leave acoustical work free of dirt, marks or faulty material.

3.4.2 Clean adjacent surfaces soiled by work.

3.4.3 Replace damaged acoustical materials.

END OF SECTION

## SECTION 09250

### GYPSUM WALL BOARD

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American Society for Testing and Materials (ASTM)

A 641-89	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
C 36-85 (1988)	Standard Specification for Gypsum Wallboard
C 475-89	Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
C 630-90	Standard Specification for Water-Resistant Gypsum Backing Board
C 645-88	Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
C 954-86	Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
C 1002-88	Standard Specification for Steel Drill Screws for the Application of Gypsum Board

##### 1.2 SUBMITTALS: Not used.

### 1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Store gypsum board at least 24 hours before installation in well ventilated, covered area heated to at least 55° F.

1.3.2 Maintain above environment throughout application of gypsum board and at least 24 hours after.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Gypsum Board

2.1.1.1 Fire-retardant board: ASTM C 36, 5/8 inch thick Type "X".

#### 2.1.2 Metal Trim

2.1.2.1 Corner beads: United States Gypsum Co No. 103.

2.1.2.2 Casing beads: United States Gypsum Co No. 200A or 200B.

2.1.2.3 Control joints: United States Gypsum Co No. 093.

2.1.3 Reinforcing Tape (Joint Tape): ASTM C 475, 1-7/8 inch to 2-1/4 inch wide in accordance with manufacturer's standards.

2.1.4 Nails: ASTM C 514, cement coated, 6d (1-7/8 inch) for 5/8 inch gypsum board.

2.1.5 Screws: Steel, self-tapping, phillips head, ASTM C 954 for steel studs 0.0336 inch and heavier, and ASTM C 1002, Type G (for gypsum), Type S (for steel studs 0.0247 inch), length recommended by the gypsum board manufacturer, 1 inch minimum.

2.1.6 Joint Compound: ASTM C 475

2.1.7 Steel Studs and Runners: Screw studs, nonloadbearing channel type, roll-formed from 0.0247 inch painted or galvanized steel noted on the drawings, nominal 1 inch flange width, meeting the requirements of ASTM C 645.

2.1.8 Adhesive: Recommended by manufacturer of gypsum board.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### 3.1.2 Steel Framing at Walls

3.1.2.1 Frame walls and ceilings with steel studs 16 inches on center or as shown otherwise on drawings.

3.1.2.2 Align runners accurately. Fasten to floors with concrete anchors or other approved method at 24 inches on center maximum. Floor track to be set in mastic as shown on sheet H-2-82724. Fasten ceiling runners at each stud.

3.1.2.3 Plumb studs and attach to top and bottom runners with at least 1 gypsum board screw on each side of stud end. Install studs in continuous lengths. C Clip 2 inch studs to each wall girt of pre-engineered building.

3.1.2.4 Install 20 gauge metal backing where required for anchoring to wall with at least 2 gypsum board screws on each stud.

### 3.2 APPLICATION

#### 3.2.1 Gypsum Board, General

3.2.1.1 Inspect framing scheduled to receive gypsum board.

3.2.1.2 Apply gypsum board first to ceilings and then to walls. Use boards of maximum practical lengths in order to minimize joints. Bring boards into contact, but do not force into place. Fit boards neatly where ends or edges abut.

3.2.1.3 Install fasteners at least 3/8 inch from edges.

#### 3.2.2 Ceiling Installation

3.2.2.1 Single ply: Apply gypsum board with long dimension at right angles to furring members. Stagger end joints.

#### 3.2.3 Wall Installation

3.2.3.1 Single-ply: Apply parallel or perpendicular to framing or furring members. Attach ends and edges over framing or furring members except where treated joints occur at right angles to members. Stagger joints on opposite sides of partition. When installing board perpendicular, attach upper board first. Perpendicular application will not be permitted on fire rated wall construction.

#### 3.2.4 Attachment to Steel Framing

3.2.4.1 Fasten gypsum board to framing with screws. Drive screws with clutch-controlled power screwdrivers. Drive head slightly below surface without breaking paper.

3.2.4.2 Space screws 12 inches on center into each bearing for ceilings and 16 inches on center into each bearing for walls.

### 3.2.5 Taping and Finishing

3.2.5.1 Apply compound over joints in thin uniform layer, spread at least 3 inches wide, center reinforcing tape on joint and embed in compound. When dry apply second coat of taping compound in thin uniform coat, minimum of 6 inches wide. Sand to eliminate ridges and high points.

3.2.5.2 Apply third coat of taping compound after second coat is dry and has been sanded. Feather out to minimum width of 12 inches. After compound has dried, sand as necessary to obtain uniformly smooth surface.

3.2.5.3 Finish over fasteners to be similar to finish over joint tape.

#### 3.2.5.4 Corner treatment

a. Treat internal corners in manner specified for joints except fold reinforcing tape lengthwise through middle and fit neatly into corner.

b. Fit corner bead neatly over external corner and fasten with screws approximately 6 inches on center and drive into framing members. Treat with joint compound and reinforcing in manner specified for joints. Feather out joint compound from 8 to 10 inches on each side of corner.

END OF SECTION

## SECTION 09300

### FIBER REINFORCED PLASTIC (FRP) WALL PANELS

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American Society for Testing and Materials (ASTM)

1991 Edition

Factory Mutual Approval Guide

C 36-85 (1988)

Standard Specification for  
Gypsum Wallboard

C 645-88

Standard Specification for  
Non-Load (Axial) Bearing Steel  
Studs, Runners (Track), and  
Rigid Furring Channels for  
Screw Application of Gypsum  
Board

D 543-56T 24

Chemical and Stain Resistance

1.2 SUBMITTALS: Refer to Section 1300 for submittal procedures.

1.2.1 MANUFACTURER'S DATA: Submit manufacturer's product description, guidelines and installation instructions.

##### 1.3. DELIVERY, STORAGE AND HANDLING

1.3.1 Deliver materials in original containers with manufacturers' labels intact.

1.3.2. Panel should be unwrapped, removed from skid and stacked on a flat, dry surface.

1.3.3 Panels shall be pre-conditioned for at least 24 hours in temperature and humidity conditions of installation area.

1.3.4 Protect eyes with goggles and use mouth filter mask when cutting FRP wall panels.

1.3.5. Certificate of compliance: Submit manufacturer's certification that all materials furnished for project comply with requirements specified herein.

1.3.6. Maintenance Replacement Panels: Furnish nearest number of full-sized panels and trim shapes to equal 1 percent of total material installed.

## PART 2 - PRODUCTS

2.1 PRODUCT: Fiber reinforced plastic (FRP) wall panel, factory applied to 5/8" type x gypsum board. Similar to Fiber-Lite as manufactured by Nudo Products, Inc., 2508 Grand Ave., Springfield, IL 62707 (800) 826-4132.

2.1.1 Panel: F 3 PB 625-FR

2.1.2 Color white, textured.

2.2 COMPONENTS: Provide adhesives, sealants, moldings, fasteners and other components for complete system as made by manufacturer of panel product or recommended in writing by such manufacturer as best suited for purpose intended.

2.2.1 Moldings: Vinyl moldings, colored to match panels, as recommended by manufacturer for each particular condition.

2.2.2. Sealant: Super Silicone Adhesive, SS-W (white) for white panels.

2.2.3 Adhesive: Moisture-retardant Type I material designed for securement of FRP panels to gypsum drywall.

2.2.4 Fasteners: Stainless steel, with painted checkered head color to match panels or moldings.

2.2.4.1 For securing to light gage metal studs, provide self-tapping type screws.

## PART 3 - EXECUTION

3.1 INSTALLATION: Comply fully with recommendations of manufacturer and final shop drawings.

3.1.1 Install units in configurations as shown on final shop drawings and in accordance with manufacturer's instructions. Keep vertical lines straight and plumb. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim and accessories for complete installation.

3.1.2 Provide appropriate moldings at all panel joints, internal and external corners, at intersections with other construction, elsewhere as required.



3.1.3 Seal panels at moldings full length, at edges of cutouts for piping and the like, at tops and bottoms of panels, and at all other intersections with other construction.

3.1.4. Coordinate installation with that of trades providing studs and other concealed supports. Locate all fasteners only over centers of concealed supports, including properly located and installed nailers or support plates between studs where required.

3.2 CLEANING, ADJUSTMENT, INSTRUCTIONS:

3.2.1 Verify that accessories required for each unit are properly installed.

3.2.2 Clean surfaces in accordance with manufacturer's instructions.

3.2.3. Provide instructions to Owner's maintenance staff on care of panel surfaces.

END OF SECTION

SECTION 09510  
SUSPENDED ACOUSTICAL CEILING

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

A 641-89	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
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C 635-86	Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings
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C 636-86	Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay In Panels
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D 1779-65(1983)	Standard Specification for Adhesive for Acoustical Materials
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E 1264-90	Standard Classification for Acoustical Ceiling Products
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1.1.1.2 International Conference of Building Officials (ICBO)

UBC Standard 47-18 1988 Edition	Uniform Building Code (UBC) Standards
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Report No. 4071	Seismic Connection Details for Gypsum Wall Board Nonbearing Partitions and Suspended Ceilings
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1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

SECTION 09805  
SPECIAL PROTECTIVE COATING

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Specifications: The following specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 List of Materials: Submit complete list of materials, colors and location to be used, to substantiate compliance with the Drawings and this Section. List shall enumerate percentage of volatile and nonvolatile materials and percentage of component parts of each type of material.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Deliver materials to site in manufacturer's unopened containers with labels intact. Do not open containers or remove labels until after inspection and acceptance by KEH Acceptance Inspector.

1.3.2 Store materials in accordance with manufacturer's recommendations and in well ventilated area not exposed to excessive heat, sparks, flame or direct rays of sun.

1.4 PROJECT CONDITIONS

1.4.1 Environment for Coating: Coat surfaces only when ambient and surface temperatures are between 35 F and 120 F, and temperature is 5 F above dewpoint.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Coating materials are products of Carboline, 350 Hanley Industrial Ct., St. Louis Missouri 63144, (314) 644-1000, unless otherwise specified.

2.1.2 Filler: Nu-Klad 114.

2.1.3 Primers

2.1.3.1 Dimetcote Steel Primer 205.

2.1.3.2 Carboline Phenoline 305

2.1.4 Finish Coatings

2.1.4.1 Carboline Phenoline 305

PART 3 - EXECUTION

3.1 INSPECTION

3.1.1 Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into acceptable condition through preparatory work included in Article 3.2.

3.1.2 Report in writing to KEH Acceptance Inspector conditions that may potentially affect proper application of finish. Do not commence surface preparation or coating application until defects have been corrected and conditions are made suitable.

3.2 PREPARATION

3.2.1 General

3.2.1.1 Before application, sweep and dust space or area to receive coating.

3.2.2 Pre-Priming

3.2.2.1 Clean concrete surfaces of laitance, oil, stains, dust and other foreign material.

a. Where laitance has not been removed, treat concrete with uniform application of 1 of following solutions.

- 1) 1 part 10 percent solution muriatic acid and 3 parts water.
- 2) 5 percent solution of trisodium phosphate.

b. When solution ceases to foam, rinse thoroughly with clean water and scrub with stiff bristle brush. Allow treated area to thoroughly dry. Scratches, cracks, holes and abrasions shall be cut back to proper key and filled with Nu-Klad 114.

c. Allow concrete to cure 30 days before coating is applied, except coating may be applied after concrete has cured 21 days if moisture content of concrete is less than 12 percent.

3.2.3 Post Priming

3.2.3.1 Feather abrasions, chips, skips and holidays occurring in prime coat by sanding and recoat with material and color to minimum dry film thickness specified.

3.2.3.2 Previously coated surfaces shall be recoated only after existing film is completely dry.

3.2.3.3 Protect coating from rain until dry to touch.

### 3.2.4 Protection

3.2.4.1 Provide and install drop cloths, shields and other protective devices required to protect surfaces adjacent to areas being coated. Keep spatter, smears, droppings and over-run of coating materials to minimum and remove as coating work progresses.

3.2.4.2 Remove or otherwise protect electrical and mechanical items before starting work. Clean and reinstall upon completion of work in each area. Use no solvent or abrasives to clean items that will remove lacquer finish normally used on some items.

## 3.3 APPLICATION

3.3.1 Apply coating materials in accordance with manufacturer's recommendations.

3.3.2 Apply with equipment recommended by manufacturer.

3.3.3 Identify each coat of opaque material by its relation to color of finish coat. Prime coat shall be darkest tint of specified color with each succeeding coat lighter, up to finish coat, which shall be color, tint and sheen specified. Tints of identical coats of identical color and material shall not vary.

## 3.4 FIELD QUALITY CONTROL

3.4.1 Inspection: KEH Acceptance Inspector will perform tests to ascertain that coating materials have been applied in accordance with this Section.

## 3.5 CLEANING

3.5.1 Furnish and maintain at site, closed metal containers for disposal of waste materials. Place materials spotted or soaked with paint, oil or solvents in containers.

3.5.2 Brushes, rollers, spatulas and spray equipment shall be thoroughly cleaned after each use and shall contain no oils, thinners or other residue after such cleaning.

3.5.3 Remove empty cans from site at end of each shift.

3.5.4 At completion of coating work, remove materials, containers, rags, cloths, brushes, and other equipment from site. Clean up spills.

3.6 COATING SCHEDULE

Minimum Wet Film Thickness  
and Percent-Minimum age of Film  
Forming Dry Film  
Solids per Volume Thickness

3.6.1 Concrete

Prime: Carboline-Phenoline 305 Concrete	8 mils & 50% 4 mils
Dimetcote 205	8 mils & 50% mils
Finish: Carboline-Phenoline 305 Finish	8 mils & 50% 4 mils

3.6.2 Steel

Prime: Carboline-305	8 mils & 50% 4 mils
Finish: Carboline Phenoline 305	6 mils & 68% 4 mils

END OF SECTION

## SECTION 09900

### PAINTING

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Painting and Decorating Contractors of America (PDCA)  
1984 Architectural Specification  
Manual

##### 1.2 SUBMITTALS

1.2.1 List of Materials: Submit list including manufacturers' names, specifications, recommendations, and other data necessary to show compliance with requirements.

1.2.2 Color Samples: Colors will be selected by KEH Design Engineer. Submit samples in form of 3 inch by 5 inch color chips. Describe coating material, manufacturer, and color identification on reverse face of each chip. Retain one set of approved samples at site for use as quality standard of final finishes.

##### 1.3 QUALITY ASSURANCE

1.3.1 Use manufacturers and products listed in PDCA Architectural Specification Manual, Chapter 7.

##### 1.4 DELIVERY, STORAGE, AND HANDLING

###### 1.4.1 Packing and Shipping

1.4.1.1 Deliver materials to site in sealed, original, labeled containers, each bearing manufacturer's name, product type, brand name, color designation, and mixing and reducing instructions.

###### 1.4.2 Acceptance at Site

1.4.2.1 Verify undamaged condition.

1.4.2.2 Do not open containers not approved by KEH Acceptance Inspector.

### 1.4.3 Storage and Protection

1.4.3.1 Store and mix materials at minimum ambient temperature of 45 F in well ventilated and heated area or areas in accordance with manufacturer's recommendations.

1.4.3.2 Take precautions to prevent fire hazards and spontaneous combustion. Place cotton waste, cloths, and hazardous materials in containers and remove from site daily.

1.4.3.3 Toxic, acidic, and explosive materials: Take regular appropriate safety precautions in accordance with manufacturer's recommendations and Section 01100 ( Special Project procedures).

### 1.5 PROJECT CONDITIONS

#### 1.5.1 Environmental Requirements

##### 1.5.1.1 Temperature

a. Unless otherwise recommended by paint manufacturer, apply coatings when ambient and surface temperatures are between 45 and 95 F except water-thinned paints and other special coatings. Apply water-thinned paints when ambient and surface temperature is between 50 and 90 F. Apply epoxy coatings when conditions are within humidity and temperature limits recommended by coating manufacturer.

b. Provide temporary heat as required until specified surface and air temperatures exist for required time period. Maintain temporary heat for 24 hours after paint and finish application.

##### 1.5.1.2 Weather

a. Do no exterior work on unprotected surfaces if it is raining or moisture from other source is present or expected before applied finishes can dry or attain proper cure without damage.

b. Allow surfaces to dry and attain required temperatures and conditions specified before proceeding with work or continuation of previously started work.

c. Do not apply finish in areas where dust is being generated.

1.5.1.3 Humidity: Follow manufacturer's directions for extremes.

1.5.1.4 Ventilation: Provide adequate continuous ventilation required for drying various materials as recommended by manufacturer.

1.5.1.5 Illumination: Provide temporary lighting to attain minimum surface lighting level of 15 footcandles per square foot.



## 1.6 MAINTENANCE

1.6.1 Extra Materials: Leave one properly labeled and sealed quart can of each type and color of paint and other coating products taken from batch mix.

1.6.1.1 Label for positive identification.

1.6.1.2 Store where directed.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Furnish materials identified in PDCA Architectural Specification Manual, Chapters 5,6, and 7 for systems scheduled in Article 3.5.

2.1.2 Furnish ready-mixed materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

3.1.1 Examine surfaces scheduled to receive finish for conditions that will adversely affect execution, permanence, or quality of work and which cannot be put into acceptable condition through preparatory work included in Article 3.2.

3.1.2 Report in writing to Field Contract Engineer conditions that may affect proper application of finish. Do not begin surface preparation or coating application until defects have been corrected and conditions are made suitable.

### 3.2 PREPARATION

#### 3.2.1 Protection

3.2.1.1 Protect finished work of other trades and following.

a. Plastic piping, brass, bronze, copper, plated metals, and stainless steel not scheduled for further finish.

b. Plastic laminate surfaces.

c. Glass, unless otherwise noted.

d. Materials having complete factory finish, such as electrical switchplates, lighting fixtures, and finish hardware.

3.2.1.2 As work proceeds, and upon completion of work, promptly remove spills, splashes, or splatters from products by methods not damaging to affected surfaces.

3.2.1.3 Repair or replace, as directed by KEH, surfaces damaged by painting work.

3.2.1.4 Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, fastenings, and similar items before starting work. Carefully store, clean, and reinstall items upon completion of work in each area. Do not use cleaning agents detrimental to permanent lacquer finishes.

### 3.2.2 Preparation

3.2.2.1 Prepare surfaces in accordance with recommendations of finish material manufacturer and PDCA Architectural Specification Manual, Chapters 3 and 3R, for finish system specified.

3.2.2.2 Obtain written approval from KEH for dry or liquid abrasive blasting.

### 3.3 APPLICATION

3.3.1 Perform work in accordance with manufacturers directions, PDCA Architectural Specification Manual, and this Section.

### 3.4 FIELD QUALITY CONTROL

3.4.1 Inspection and testing will be performed by KEH Acceptance Inspector.

3.4.2 Meet the requirements of PDCA Architectural Manual for "PREMIUM" material and work, unless otherwise specified.

### 3.5 SCHEDULES

#### 3.5.1 Color

#### 3.5.2 Paint and Finish

##### 3.5.2.1 Exterior

a. Ferrous metal: Light and ordinary exposures, not galvanized.

Ext. 12-A, Custom Grade, low gloss.

d. Galvanized (zinc-coated) metal.

Ext. 14-A, Custom Grade, low gloss.

3.5.2.2 Interior

- a. Gypsum wallboard, walls and ceilings.

Premium Grade, semi-gloss sealer with acrylic-epoxy coating similar to Tnemec-Tufcoat.

- b. Concrete floors.

See Section 09805.

- c. Exposed ferrous metal: Light and ordinary exposures, except galvanized.

Int. 12-A, Premium Grade, semi-gloss.

- d. Galvanized (zinc-coated) metal.

Int. 13-A, Custom Grade, gloss.

END OF SECTION

## SECTION 10500

### LOCKERS AND STORAGE CABINET

#### PART 1 - GENERAL

- 1.1 REFERENCES: Not applicable.
- 1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.
- 1.2.1 Manufacturer's Data: Submit manufacturer's catalog cuts of lockers. Show construction, equipment, arrangement, numbering, and details of installation.
- 1.2.2 Color Samples: Submit complete color sample range for selection.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

2.1.1 Lockers and Storage Cabinet: Manufactured by Lyon Metal Products; Medart, Incorporated; or Republic Steel Corp.

2.1.1.1 Double-tiered with each locker 15 by 15 by 36 inches, storage cabinet is 15 by 15 by 72.

2.1.1.2 Doors: 0.0598 inch, stretcher-leveled, cold-rolled sheet steel, top and bottom flanged, sides formed into channel, louvers at top and bottom.

2.1.1.3 Face frames: 0.0598 inch cold-rolled sheet steel, formed into channel shape with integral door stop, corners welded.

2.1.1.4 Body: Cold-rolled sheet steel, exposed ends 0.0359 inch minimum, other sheets 0.0239 inch minimum. Bottom of each locker compartment and storage cabinet formed from galvanized sheet. Fasteners cadmium or zinc plated.

2.1.1.5 Continuous 0.0359 inch sloping tops in addition to tops of individual lockers with end finishing panels for free-standing lockers.

2.1.1.6 Equip with prefabricated closed base.

2.1.1.7 Full loop, tight pin, 5 knuckle, 0.0747 inch hinges welded to face frame and riveted to door. Doors equipped with rubber silencers.

2.1.1.8 Each locker to have 1 double prong hook at top and single prong hooks on back and each side. Hooks to be round tip, cadmium-plated. Storage Cabinet to have 3 adjustable shelves.

2.1.1.9 Each locker and storage cabinet to have number plate riveted on, and cadmium-plated latching device with provision for padlocking.

2.1.1.10 Steel: Bonderized and finished with baked enamel. Color to be selected from manufacturer's standard colors.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

3.1.1 Assemble and install lockers and storage cabinet in accordance with manufacturer's instructions. Install accurately aligned, flush, level, and plumb. Make joints and fastenings tight.

3.1.2 Anchor lockers securely to floor and base.

#### 3.2 ADJUSTING AND CLEANING

3.2.1 Replace damaged or defaced items.

#### 3.3 PROTECTION

3.3.1 Protect finish until completion of Project.

END OF SECTION

## FIRE EXTINGUISHERS AND CABINETS

## 1.1 REFERENCES

1.1.1.1 NFPA 10 Portable Fire Extinguishers

UL STANDARD 299

**1.2 SUBMITTALS:** Refer to Section 01300 for submittal procedures.

### 1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Store extinguishers and cabinets in original containers off ground and protected from damage. Store extinguishers in secure area, install at final turnover.

## 2.1 ACCEPTABLE MANUFACTURERS

### 2.1.1 J.L. Industries

### 2.1.2 Larsen's Mfg. Co.

### 2.1.3 Muckje

## 2.2 EXTINGUISHERS

2.2.1 ABC Dry Chemical 10 lbs painted steel tank, similar to those manufactured by J.L. Industries.

## 2.3 CABINETS

2.3.1 Cabinet: Formed sheet steel, 18 gage, semi-recessed type, painted white, size 10-1/2 x 24 x 4 inches. Clear Vu Series 1515 manufactured by J.L. Industries.

2.3.2 Trim: Flat, 1-1/4 inches wide face, steel, painted white.

2.3.3 Door: White painted steel, 18 gage thick, reinforced for flatness and rigidity; latch access.

2.3.4 Glazing: 1/8 inch thick vacuum formed red acrylic.

2.3.5. Mounting Hardware: Appropriate to cabinet.

### PART 3 - EXECUTION

#### 3.1 FABRICATION

##### 3.1.1 General

3.1.1.1 Form body of cabinet with tight inside corners and seams.

3.1.1.2 Predrill holes for anchorage.

3.1.1.3 Form perimeter trim and door stiles by welding, filling, and grinding smooth.

#### 3.2 INSTALLATION

3.2.1 Install cabinets plumb and level in wall opening, 48 inches from finished floor to inside bottom of cabinet. See floor plans for locations of fire extinguisher cabinets.

3.2.2 Secure rigidly in place in accordance with manufacturer's instructions.

3.2.3 General contractor shall provide adequate backing and support for cabinet.

#### 3.3 FINISHES

3.3.1 Extinguishers: Red enamel.

3.3.2 Cabinet Trim and Door: White enamel.

3.3.3 Cabinet Interior: White enamel.

#### 3.4 INSPECTION

3.4.1 Verify rough openings for cabinet are correctly sized and located.

3.4.2 Beginning of installation means acceptance of existing conditions.

[illegible]



## SECTION 11300

### FLUID WASTE TREATMENT AND DISPOSAL EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

- 1.1.1.1 American Society of Mechanical Engineer (ASME)  
B16.1-89 Cast Iron Pipe Flanges and Flanged Fittings.
- 1.1.1.2 American Society of Civil Engineers (ASCE)  
ASCE 7-88 Minimum Design loads for Buildings and other Structures
- 1.1.1.3 American Society for Testing and Materials (ASTM)  
D-3299 Filament-Wound Glass-Fiber-Reinforced Thermostat Resin Chemical-Resistant Tanks
- 1.1.1.4 International Conference of Building Officials (ICBO)  
1988 Edition Uniform Building Code (UBC)
- 1.1.1.5 US Department of Transportation  
40CFR ch.1 (10-88) Paragraph 178.82, specification 5B; steel barrels of drums
- 1.2 SUBMITTALS: Refer to Section 01300 for submittals procedures.
- 1.2.1 Approval:
  - 1.2.1.1 Approval Date List: Submit information listed in Column 5 of Approval Data List in this Section.
  - 1.2.1.2 Filler Material: Submit procedure for storing and control of all filler materials.

1.2.2 Vendor Information (VI): Submit information listed in Column 5 of Vendor Information List in this Section.

1.2.3 Design/Fabrication Drawings: Submit dimensioned design fabrication and installation drawings complete with material of tanks.

1.2.3.1 Certificates of Conformance or Compliance: Fabrication drawings shall be accompanied by stress values and certificate signed by a registered professional structural engineer stating design criteria and procedures used and attesting to adequacy and accuracy of design.

1.3 Tank Design Criteria: Design in accordance with UBC, ASTM D-3299 for hydrostatic loads and drawings. Number H-2-82743, H-2-82744, and H-2-82745.

1.3.1 Maximum hoop strain shall be 0.0010 in/in when produced by hydrostatic loads.

1.3.2 Vertical Live and Snow Loads:

a. Design the top area of the tank for 250 pound concentrated live load over 1 foot by 1 foot area.

b. In addition to the concentrated loads, design for 20 psf snow or live load uniformly distributed over the top of the tank.

1.3.3 Wind Loads: Design in accordance with ASCE 7, Section 6, using the following criteria:

a. Basic wind speed 70mph.

b. Importance Factor:  $I=1.07$  (for 100 year recurrence level).

c. Exposure category: C.

1.3.4 Base seismic loading on Seismic Zone II in accordance with UBC Section 2312.

a. Axial strains due to seismic loads are limited to 0.00133 in/in with a 33% increase allowed by the Uniform Building Code.

1.3.5 Auxiliary Loads: In addition of concentrated loads, design for auxiliary equipment loads such as man-ways, pumps, guard rails and piping, and stairs.

1.3.6 Maximum deflection in top shall not exceed 1/180 of spans. Maximum deflection in side shall not exceed 1/190 of span.

1.3.7 Vector addition of hoop and axial strains shall be limited to 0.00133 in/in with a 33% increase allowed by the Uniform Building Code.

1.3.8 Safety factor against buckling of the tank shell walls due to axial compressive stresses produced by seismic loads shall be always greater than 4.0.

1.3.9 Layout Drawings: Location, number and size of inlets, outlets, manway, ladder and guard rails are shown on the drawings listed above.

1.3.10 Chemical Radioactive Waste Water Analysis: Table No. 1 indicates the average concentrations of chemicals into the plant. The pH range is 7 to 8 with a worst condition pH of 5.3. See Table No. 1, appended.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Preserve identity of materials from time of receipt on site until use in facility construction.

1.4.2 Store separately materials meeting requirements of different material specifications.

1.4.3 Store and control filler material in accordance with approved procedure.

1.4.4 The KEH Acceptance Inspector may examine welding and brazing materials for compliance with procedure specifications.

1.5 Furnished Equipment: Not used.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

##### 2.2 EQUIPMENT

##### 2.2.1 Tanks T-101, T-102

2.2.1.1 Fiberglass reinforced plastics (FRP) tanks as manufactured by Xerxes or approval substitute.

##### 2.2.1.1 Tank Construction

a. Inner surface exposed to the environment shall be 10-20 mil resin-rich surface reinforced with a chemical resistant glass surface material. The inner surface shall be comprised of 90% resin/10% glass.

b. Interior layer, which is backing the inner surface, is a resin-rich, random oriented chopped glass strand layer no less than 80 mils

thick having a resin content of between 70 and 80% and a glass content between 30 and 20% respectively.

c. Exterior structural laminate helical: The filament winding process shall be continuous filaments of resin-impregnated glass applied to the interior layer as part of the overall tank structural support. These filaments are machine-wound at approximately  $70^{\circ}$  and  $-70^{\circ}$  to the tank's longitudinal axis. Glass content 65 to 75% and resin accounts for 35 to 25% of the total material weight of this stage.

d. Circumferential exterior layer: The tank design requires continuous filaments of resin-impregnated glass are applied as in c. above, except the wind angle is at  $90^{\circ}$  to the tank's longitudinal axis to provide hoop strength.

e. Unidirectional exterior layer: The unidirectional layer shall be comprised of resin-impregnated glass fibers which are applied along the longitudinal axis of the tank.

2.2.1.2 Tank Configuration: See drawings H-2-82743, H-2-82744, and H-2-82745 for style configuration.

#### 2.2.1.3 Accessories

a. See drawings for location, number and size of accessories.

b. Seismic filament wound tanks include a lug design which allows for a limited misalignment of anchor bolts.

c. Ladders, platforms and hand rails shall meet current OSHA specifications. These accessories shall be factory fitted to tank and field assembly by an authorized manufacturer's representative. See drawings H-2-82743, H-2-82744, and H-2-82745 for additional requirements.

d. Manways shall meet all requirements of ASTM D-3299. Cadmium plated bolts, nuts, washers and neoprene gaskets shall be provided.

e. Flanged nozzles: Both hand layup and filament wound flanges shall meet ASTM-D-3299 specifications with all bolt hole sizes and circles to ASME-B16.1.

f. Vents: All tanks must be vented to prevent serious damage from excess pressure or excess vacuum typically occurring during loading or off loading of liquids respectively. The goose-neck vent shall be equipped with screens.

g. Drains: Not used.

h. Lifting lugs: Unless otherwise specified, all filament wound tanks are equipped with 2 opposing carbon steel lifting lugs. Tie down lugs shall work as lift lugs.

i. Tie down lugs: Carbon steel tie down lugs are secured to the tank wall by circumferential fiberglass wrapping which is positioned by the lug's ribbed backing plate. Seismic type of construction and featuring a box-style foot section to allow for misalignment of tie down bolts.

j. Mounting brackets: Typically fiberglass, these utilitarian brackets serve to provide support mounts for external accessories such as piping and instrumentation.

k. Tank exteriors: Unless otherwise specified, a typical Xerxes tank will carry a label showing date of shipment, capacity, resin system, inner liner data, temperature limits and serial number. Tank drawing tag number shall be provided on tank.

1. Tank 102 shall have the conic bottom sections heat traced and insulated to maintain temperature of water at 45° F when the tank is filled to the top of the conic section and the ambient temperature is -5° F.

#### 2.2.1.4 Tank Schedule

<u>Tank Label</u>	<u>Service</u>	<u>Nominal Vol. Gals.</u>	<u>Dimensions</u>
T-101	Inlet Sump	1,000	7' x 5' Diameter
T-102	Feed	5,000	16' x 8' Diameter
T-201	KOH	Specified with KOH addition package	

#### 2.2.2 Sump Pumps P-101/A,B

2.2.2.1 Pump Style: Goulds NM 3175 (1 x 1½-6") Vertically mounted centrifugal sump pump or equal.

2.2.2.2 Type Construction: Vertical centrifugal sump pumps, constructed of non-metallic (FRP) materials and selected for compatibility with fluids being handled. (Ref Table No. 1)

Pump suction assembly shall extend 6.5 ft below mounting plate. Impeller shaft shall be constructed of stainless steel. Impeller to be non-metallic 5.5 inches diameter dynamically and balanced for vibration free operation. Column bearings shall be of Rulon® or equivalent. Thrust bearings shall be lubricated for life and sealed to prevent contamination.

All bolts below pump mounting plate to be in full compatibility with liquid being handled, and those above mounting plate to be stainless steel.

All "O" rings used for sealing plastic between shaft sleeve sections and impeller and sleeving at lower end of shaft to be Viton.

Pump mounting or cover plate to be solid plastic sheet of thickness required to support pump and motor unit.

Pump to be completely assembled and performance tested at factory before shipment, with all data stored in perpetuity.

Special for this application: Electric motor to be sized for non-overloading performance for complete length of pump requirements with impeller diameter required. Motor to be TEFC with C-faced mounting flange.

2.2.2.3 Fluid Characterization: See appended PFP Waste Water Characterization, Table No. 1.

2.2.2.4 Installation: Complete installation instructions including drawings showing all mounting bolt hole locations, discharge pipe orientation, etc., to be furnished.

2.2.2.5 Capacity: 45 gpm at 95 ft of head.

2.2.2.6 Temperature Rating: 40° - 90° F.

2.2.2.7 Pressure Rating: Minimum 60 psig.

2.2.2.8 Electric Motor Requirement: 5 BHP delivered at 3450 rpm, 3 phase, and voltage as per drawings.

2.2.3 Visual In Line Flow Indicators: VFI-26 (1/2" size), and VFI-1 to VFI-24, VFI-31 to VFI-36 (1" size) and VFI-28-30 (1"size).

2.2.3.1 Style: Eugene Ernst Products Co., Style No. 752, Model RA812 (1"), Model RA840 (1") and Model RA404 (1/2") or equal.

2.2.3.2 Type of Construction: Pyrex sight glass in stainless steel housing. FNPT to match pipe size. Sight glass should give approximate indication of flow rate.

2.2.3.3 Installation: Install as shown on P&ID in vertical position with upward flow.

2.2.3.4 Capacity approximately 1-4 gpm for 1/2" size (RA 404) sampler flow and 3-12 gpm for 1" size (RA 812) process canisters and 10-40 gpm (KA840) drum washing..

2.2.4 Static Mixer, S-201A, S-201B, S-201C

2.2.4.1 Mixer Style: KOCH Engineering Company, Inc., Static Mixing Element SMV in line mixer with 2 mixing elements or equal.

2.2.4.2 Type of Construction: 316 stainless steel elements in 1-1/2 inch schedule 80 pvc or polypropylene housing. Elements to be retained with 150 psig flanged retainer assembly.

2.2.4.3 Installation: Install as per drawings. Complete installation and maintenance instructions to be furnished.

2.2.4.4 Temperature Rating: 40° - 90° F.

2.2.4.5 Pressure Rating: Minimum of 50 psig.

2.2.5 KOH Addition System, T-201

2.2.5.1 Style: Crane Package Chemical System, skid mounted, self-contained caustic preparation and addition system or equal.

2.2.5.2 Type of Construction: 350 gallon polyethylene tank with cover and a tank stand and carbon steel agitator supports. E.M.I. model RG-4, 1/2 H.P. 1750 rpm A.C. motor. The shaft and propeller will be plastic coated. A Crane 200 Series Duplex Metering pump with size 1 plunger PVC heads and 90 volt, D.C. motor, 1/4 H.P., 1750 RPM will be able to pump 0.6 gallons per hour. The system shall be equipped with a Seco Bronco II model 169 SCR variable speed control with 4-20 ma signal follower, stainless steel pressure gauge, liquid filled, 0-100 PSI with diaphragm gauge guard, PVC. All the pipe and fittings on this system to be PVC and the system is to sit on a 4'x 4' carbon steel base.

Tank shall be equipped with an impact protected sight glass or other visual level indicator. The pump discharge shall be pressure relieved to the tank or pump suction to protect against over pressure in the event of discharge pipe shut off. Tank shall be equipped with two 1 inch flanged nozzles on side of tank near the top for connection to water and concentrated caustic addition systems.

2.2.5.3 Installation: Install as per manufacturer's instructions. Furnish drawings, complete equipment list, maintenance instructions and operating instructions.

2.2.6        Sampler: S-101.

2.2.6.1     Style: Electric driven flow proportional composite sampler controlled by 4-20 ma signal. Collins Product Company Model 42 or equal.

2.2.6.2     Type Construction: Stand mounted on open frame.

2.2.6.3     Fluid Characteristics: See Table No. 1, "PFP Waste Water Characteristics."

2.2.6.4     Installation: Install in process building as shown in drawings and as per vendor instructions. Furnish operating instructions, parts list and maintenance instructions.

2.2.6.5     Capacity: Maximum sampling frequency such that 4 gallons may be collected over 8 hour period in not to exceed 50 ml increments. Sample composite container of 5 gallons.

2.2.6.6     Temperature Rating: 40° - 90° F.

2.2.6.7     Pressure Rating: Minimum 50 psig.

2.2.6.8     Electrical Requirements: 115V AC

2.2.7        Sampler: S-202

2.2.7.1     Style: Electric driven flow proportional composite sampler controlled by 4-20 ma signal. Collins Product Company Model 50 or equal.

2.2.7.2     Type Construction: Stand mounted on open frame.

2.2.7.3     Fluid Characteristics: See Table No. 1, "PFP Waste Water Characteristics."

2.2.7.4     Installation: Install in process building as shown in drawings and as per vendor instructions. Furnish operating instructions, parts list and maintenance instructions.

2.2.7.5     Capacity: Maximum sampling frequency such that 4 gallons may be collected over 8 hour period in not to exceed 50 ml increments. Sample composite container of 5 gallons.

2.2.7.6     Temperature Rating: 40° - 90° F.

2.2.7.7     Pressure Rating: Minimum 50 psig.

2.2.7.8     Electrical Requirements: 115V AC "nominal"



2.2.8 Filters: F-202A,B

2.2.8.1 Style: Cartridge type filter rated at 10 microns. Filter Specialists, Inc. FSC-630 or equal.

2.2.8.2 Construction Type; 304 stainless steel with 2 inch 150 psig flanged nozzles, viton gaskets, equipped with 6-30 inch FSI cartridges MF-010-P-30.

2.2.8.3 Fluid Characteristics: See Table No. 1, "PFP Waste Water Characteristics."

2.2.8.4 Installation: Install as per drawings and vendor installation instructions. Furnish equipment drawings, operating instructions and maintenance procedures.

2.2.8.5 Capacity: Initial pressure drop not to exceed 3 psi at 60 gpm.

2.2.8.6 Temperature Rating: 40° - 90° F.

2.2.8.7 Pressure Rating: Minimum 150 psig.

2.2.9 Process Canisters

2.2.9.1 Construction Style: Disposable canisters, TIGG Corporation C-15 or equal.

2.2.9.2 Type Construction: Canisters shall meet DOT 5B Hazardous Container Specifications and have a minimum working pressure of 12 psig. Material of construction shall be epoxy/phenolic lined steel. Canisters to be equipped with 1 inch FNPT center inlet and 1 inch FNPT effluent outlet near edge of top. Effluent to be collected through distributed collection system at bottom of canister. This item shall be government furnished equipment.

2.2.9.3 Media Characteristics: Canisters to be filled to the extent possible allowing room for unobstructed distribution at top and with room for any swelling when contacted with water. Canisters S-203 and S-206 to be filled with activated carbon TIGG 5D 1240 or equivalent. Canisters S-204 and S-207 to be filled with bone char of 8 x 28 U.S. mesh. Canisters S205 and S-208 to be filled with cation ion exchange resin. This item shall be government furnished equipment.

2.2.10 Canister Dolly

2.2.10.1 Style: Drum tilter and carrier. Dolly shall lift 55 gallon drum weighing up to 800 pounds and provide for drum rotation of a minimum of 180°. Drum shall clear minimum 24 inches from floor when rotated. Dolly to be

equipped with 2" to 8" casters and 2" to 4" swivel casters. Lifting frame shall straddle drum being lifted. 12V DC power for lifting and turning. Plan dimensions should not exceed 44" wide by 60" long.

2.2.10.2 Vendor/Model: Material Handling Specialists, Inc. Model 42-36 with Power Option Model 43-76 or equivalent.

2.2.11 Restrictive Orifice: RO-101

2.2.11.1 Construction style: Orifice plate; mounted with flanges.

2.2.11.2 Type construction: Stainless steel plate with 0.15" orifice.

2.2.11.3 Installation: Install in vertical run with upward flow.

2.2.12 Drum Washing Filter

2.2.12.1 Filter style: Bag type filter with 1" NPT fittings equipped with a 100 micron nylon filter bag. Filter Specialists, Inc. BFN - 14 or equal.

2.2.12.2 Construction type: Coated carbon steel mounted on legs with side in and side out connections.

2.2.12.3 Fluid characteristics: Sanitary tap water containing carbon, bone char, or IX resin fines.

2.2.12.4 Installation: Install in drum washing area per drawings and manufacturer's instructions.

2.2.12.5 Capacity: 45 gallons per minute.

2.2.12.6 Temperature rating: 40-90° F.

2.2.12.7 Pressure rating: 150 PSIG.

2.2.13 Back Pressure Regulator: BPR-1

2.2.13.1 Style: Adjustable spring loaded back pressure regulator with range 20-65 psig. Fisher 1½" 98H-178 or equal.

2.2.13.2 Type construction: 316 stainless steel with 150 psig flanges.

2.2.13.3 Fluid characteristics: See Table No. 1

2.2.13.4 Capacity: 45 GPM with maximum of 30 psc over pressure.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Equipment

3.1.1.1 Install where shown on drawings in accordance with manufacturer's instruction.

3.1.1.2 Coordinate location of tie down points with structural conditions.

#### 3.1.1.3 Water Flushing

a. Obtain written approval of method for disposal of flushing water from KEH field contact engineer

b. After fabrication is completed, flush tank until effluent is clean and contains no visible particulate matter.

c. Provide documented evidence that flushing has been accomplished in accordance with this Section. Deliver this evidence to KEH Acceptance Inspector before leak/pressure testing.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Leak/Pressure Testing of Equipment

3.2.1.1 Install necessary restraining devices, before filling tank or applying test pressure to other equipment.

3.2.1.2 All equipment install in piping shall be tested in accordance with "Leak/Pressure Testing of Piping" for appropriate type of piping.

3.2.1.3 Isolate instruments and other items which could be damaged by test pressures.

3.2.1.4 Perform leak/pressure test in presence of KEH Acceptance Inspector unless otherwise instructed in writing.

3.2.1.5 Examine tank and piping joints, fittings, and other potential leak sources during testing. Repair leaks in accordance with approved repair procedure, re-examine by same test method.

3.2.1.6 Duration of fill test shall be at least two hours with no leaks and for such additional time necessary to conduct examination.

3.2.1.7 Coat tank and pipe joints, fittings and other potential leak sources including plates and anchors with mixture of powdered blue chalk and water. Allow mixture to dry before filling pipe or tank with water.

3.2.1.8 If lines are subject to freezing, remove water from lines immediately upon completion of test.

3.2.1.9 Document pressure testing of each piping system on Leak/Pressure Test Certification, form KEH-1757. See the appended sample, Section 13440.

TABLE NO. 1  
PFP WASTE WATER CHARACTERIZATION  
Concentrations (ug/l)

	<u>RANGE</u>	<u>AVE</u>		<u>RANGE</u>	<u>AVE</u>
<u>Cations</u>			<u>Anions</u>		
Aluminum	<150-370	190	Chloride	2600-4900	3500
Ammonium	<50-3300	53	Cyanide	<10	<10
Antimony	<100	<100	Fluoride	103-126	114
Barium	21-32	29	Nitrate	<500-<5000	935
Beryllium	<5	<5	Phosphate	<1000	<1000
Cadmium	<2	<2	Sulfate	13000-16900	15000
Calcium	16000-19300	18000	Sulfide	<1000	<1000
Chromium	<10	<10			
Copper	<10-26	13	<u>Organics</u>		
Iron	<30-54	44	Acetone	90-580	330
Lead	<5	<5	Chloroform	17-45	27
Magnesium	3600-4300	4100			
Manganese	5-17	6	<u>Radionuclides</u>		
Mercury	<0.1-0.1	0.1			<u>(uCi/l)</u>
Nickel	<10-6000	<10	Pu-239,240		4.3E-04
Potassium	601-6000	1300	Pu-241		1.5E-03
Silver	<10	<10	Am-241		<1.1E-03
Sodium	1850-3800	2400	Gross Alpha		8.0E-04
Zinc	12-23	22	Gross Beta		1.1E-04

TEMPERATURE: 40° TO 85° F

SPECIFIC GRAVITY: 1.0

pH: 5.3 - 8.0

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SECTION 13120  
PRE-ENGINEERED STRUCTURES

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

- |         |   |   |
|---------|---|---|
| 1.1.1.1 | American Institute of Steel Construction, Inc (AISC)<br><br>1989 Edition          | <br><br>Manual of Steel Construction,<br>9th Edition, Allowable Stress<br>Design  |
| 1.1.1.2 | American Iron and Steel Institute (AISI)<br><br>1986 Edition                      | <br><br>Specification for the Design of<br>Cold-Formed Steel Structural<br>Members  |
| 1.1.1.3 | American National Standards Institute (ANSI)<br><br>ANSI A58.1-1982               | <br><br>American National Standard<br>Minimum Design Loads for<br>Buildings and Other Structures  |
| 1.1.1.4 | American Society for Testing and Materials (ASTM)<br><br>A 446-89<br><br>A 525-87 | <br><br>Standard Specification for<br>Steel Sheet, Zinc-Coated<br>(Galvanized) by the Hot-Dip<br>Process, Structural (Physical)<br>Quality<br><br>Standard Specification for<br>General Requirements for Steel<br>Sheet, Zinc-Coated (Galvanized)<br>by the Hot-Dip Process |
| 1.1.1.5 | American Welding Society (AWS)<br><br>AWS D1.1-90                                 | <br><br>Structural Welding Code-Steel   |



- 1.1.1.6 Federal Specifications (FS)  
HH-I-521F Insulation Blankets, Thermal  
(Mineral Fiber, For Ambient  
Temperatures)
- 1.1.1.7 International Conference of Building Officials (ICBO)  
1991 Edition Uniform Building Code (UBC)
- 1.1.1.8 Metal Building Manufacturers Association (MBMA)  
1986 Edition Low Rise Building Systems  
Manual
- 1.1.1.9 Military Specifications (MS)  
MIL-S-4174B Steel Sheet And Strip, Flat,  
Aluminum Coated, Low Carbon
- 1.1.1.10 Underwriters Laboratories, Inc (UL)  
January 1991, Building Materials Directory  
Including Supplement
- 1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.
- 1.2.1 Erection Instructions and Diagrams: Submit as necessary to erect  
building and install components and containing, but not be limited to,  
following.
- 1.2.1.1 Anchor bolt layouts and sizes.
- 1.2.1.2 Structural connections.
- 1.2.1.3 Roofing and siding connections.
- 1.2.1.4 Joint sealing and caulking.
- 1.2.1.5 Door and frame installation.
- 1.2.1.6 Flashings.
- 1.2.1.7 Accessory installation.
- 1.2.1.8 Details and instructions necessary for assembly.
- 1.2.1.9 Fabrication drawings necessary to supplement instructions and  
diagrams.

1.2.2 Certificates of Conformance or Compliance: Fabrication drawings shall be accompanied by stress values and certificate signed by registered professional structural engineer, stating design criteria and procedures used and attesting to adequacy and accuracy of design.

1.2.3 Color Samples: Colors used on Project will be selected by Field Contract Engineer. Submit samples from manufacturer's 20 year coating selection.

### 1.3 SYSTEM DESCRIPTION

1.3.1 Metal Building: Single-span structure, rigid frame type.

1.3.1.1 Primary framing: Rigid frame of solid web rafter beams and straight columns; end wall columns and wind bracing.

1.3.1.2 Secondary framing: Purlins, flush side walls girts, eave struts, flange bracing, clips and other items required for complete installation.

1.3.1.3 Wall and roof system: Preformed metal panels with concealed subgirt framing/anchorage assembly, and accessory components. All lap joints shall be sealed with non sagging sealant tape.

1.3.2 Design Criteria: Design building and components in accordance with applicable sections of AISC "Manual of Steel Construction", MBMA "Metal Building Systems Manual", and AISI "Specification for the Design of Cold-Formed Steel Structural Members".

1.3.2.1 Basic design shall include live, dead, snow, wind, and seismic loads. Other design loads, either static or dynamic, shall be considered auxiliary loads.

1.3.2.2 Vertical live and snow loads

a. Design roof covering for either 50 psf uniformly distributed or 200 pound concentrated live load over 1 foot by 1 foot area located at center of maximum roof panel span, whichever produces greater stress.

b. Design primary framing and purlins for 20 psf snow or live load uniformly distributed over supported roof area.

1.3.2.3 Wind loads: Design in accordance with ANSI A58.1, Section 6, using following criteria.

a. Basic wind speed: 70 mph.

b. Importance factor:  $I=1.07$  (for 100 year recurrence level).

c. Exposure category: C.

1.3.2.4 Base seismic loading on Seismic Zone 2B in accordance with UBC Section 2312.

1.3.2.5 Auxiliary loads

a. Design roof framing for auxiliary load of 10 psf to accommodate loads imposed on building from piping, lighting fixtures, heating units, and equipment, including automatic fire sprinkler system.

b. Magnitude and location of auxiliary loads shown on the Drawings or described in this Section.

1.3.2.6 Maximum deflection in roofing or roof panels shall not exceed 1/180th of spans, and maximum deflection in siding or wall panels shall not exceed 1/90th of spans.

1.3.2.7 Provide drainage to exterior for water entering or condensation occurring within cladding system.

1.3.2.8 Install building completely weathertight, free of abrasions, loose fasteners, and deformations.

1.3.2.9 Weld steel in accordance with AWS D1.1.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Deliver, store, handle, and erect prefabricated components, panels, and other manufactured items in manner that will not damage or deform.

1.4.2 Examine sheets and panels upon arrival at site and, if found to be wet, remove moisture, restack, and protect until used. Replace damaged or defaced components unless they can be repaired to satisfaction of KEH Field Contract Engineer.

1.4.3 Stack materials stored at site before erection on platforms or pallets and cover with tarpaulins or other suitable weathertight covering.

1.4.4 Store metal sheets or panels so water which may have accumulated during transit or storage will drain off.

1.4.5 Do not store sheets or panels in contact with materials that may cause staining.

1.5 WARRANTY

1.5.1 Building shall be warranted against water leaks arising out of or caused by ordinary wear and tear by elements for period of 5 years. Warranty

shall start upon final acceptance of Work or date Operating Contractor takes possession, whichever is earlier. Colored panels shall be warranted for 20 years against fading, chalking and flaking.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Wall, Roof, and Soffit Systems

2.1.1.1 Sheet steel stock: ASTM A 446 zinc-coated to ASTM A 525 (G90). Factory color finished.

2.1.1.2 Wall system: 0.0336 inch, concealed fastening vertical flush panels.

2.1.1.3 Roof system: 0.0336 inch, concealed fastening, standing seam construction.

2.1.1.4 Soffit system: 0.0276 inch, concealed fastening, flat profile panels similar to Butler Stylwall II flat system. Attach to 1-1/4 inch by 2-1/2 inch by 3/4 inch spanning member secondary component furring.

#### 2.1.2 Insulation and Vapor Barriers

2.1.2.1 Insulation: See Section 07200.

2.1.3 Sealant: Manufacturer's standard elastomeric, nonstaining type.

2.1.4 Fasteners: Manufacturer's standard type, finished to match adjacent surface when exterior exposed.

#### 2.1.5 Accessories

2.1.5.1 Flashing, trim, caps, and similar metal accessories shall be of same thickness, material and finish used for adjacent wall or roof coverings.

#### 2.1.5.2 Gutter and downspout fabrication

a. Fabricate of same material and finish as wall metal.

b. Form gutters and downspout (scuppers) to collect and remove water flow from roof resulting from rain falling at rate of 3 inches per hour for 5 minute duration.

2.1.6 Closure Strips: Formed of compressed rubber, synthetic rubber, bituminous impregnated materials, or metal of same respective type as roof and wall panels, and standard with manufacturer. Molded closure strips shall be free of open voids and shall not absorb or retain water. Closure strips shall

be formed to match corrugations or configurations of roofing or siding being used and provided, where shown and necessary, for weathertight construction.

2.1.7 Hinged Doors and Frames: See Section 08100.

2.1.8 Hardware: See Section 08710.

2.1.9 Louver

Frame for 36" x 36" end wall louver, coordinate with mechanical.

2.1.10 Nonshrink Grout: Nonmetallic type, "Five Star Grout" by US Grout Corp; "Por-Rok" Anchoring Cement by Hallemite; or "Masterflow 713" by Master Builders, or approved substitute.

2.1.11 Finish: Precoated enamel on steel with color selected from manufacturer's standards 20 year coatings by KEH Field Contract Engineer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

3.1.1 Erect in accordance with manufacturer's approved erection instructions and diagrams.

3.1.2 Set structural elements on nonshrink grout.

3.1.3 Insulate dissimilar materials, not compatible when in contact, from each other by gaskets or insulating compounds.

#### 3.1.4 Wall and Roof Systems

3.1.4.1 Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

3.1.4.2 Fasten cladding system to structural supports, aligned level and plumb.

3.1.4.3 Use concealed fasteners for roof system and wall system.

3.1.4.4 Install sealant and gasket at wall and roof lap joints to prevent weather penetration.

3.1.4.5 System: Free of rattles, noise due to thermal movement, and wind whistles.

3.1.5 Attach gutters and downspouts to building. Install gutters to provide drainage.

3.1.6 Attach louvers to supporting construction to assure rain-tight installation. Coordinate with Mechanical. All penetrations of building to be framed and sealed to prevent infiltration.

3.1.7 Anchor doors and windows, including frames and hardware, to supporting construction, install plumb and true, and adjust to provide proper operation.

3.1.8 Insulation: Except as otherwise shown on the Drawings or approved, install insulation against covering and between supporting members to present neat appearance. Blanket insulation shall have facing at joints lapped and fastened to provide tight joints.

3.1.9 Field Painting: Upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with same material used for shop coat. Shop-primed ferrous surfaces exposed on outside of building and shop-primed surfaces of doors shall be painted with 2 coats of approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with manufacturer's recommended touch-up paint.

END OF SECTION

SECTION 13440  
INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society of Mechanical Engineers (ASME)

ASME B16.3-1985	American National Standard Malleable Iron Threaded Fittings, Class 150 and 300
ASME B16.5-1988	American National Standard Pipe Flanges and Flanged Fittings
ASME B16.9-1986	American National Standard Factory-Made Wrought Steel Butt-Welding Fittings
ASME B16.15-1985	American National Standard Cast Bronze Threaded Fittings, Class 125 and 250
ASME B16-22-1989	American National Standard Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
ASME B31.1 - 1990 Edition, w/Errata	American National Standard Code for Chemical Plant and Petroleum Refinery Piping

1.1.1.2 American Society for Testing and Materials (ASTM)

A 53-90b	Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated Welded and Seamless
A 105-87a	Standard Specifications for Forgings, Carbon Steel, for Piping Components

A 106-90	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
A 182-90a	Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High- Temperature Service
A 193-90	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High- Temperature Service
A 194-90	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
A 269-90a	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A 312-89a	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
A 403-90	Standard Specification for Wrought Austenitic Stainless Steel Pipe Fittings
B 32-89	Standard Specification for Solder Metal
B 43-88	Standard Specifications for Seamless Red Brass Pipe, Standard Sizes
B 68-86	Standard Specification for Seamless Copper Tube, Bright Annealed
B 75-86	Standard Specification for Seamless Copper Tube



B 283-89

Standard Specification for  
Copper and Copper-Alloy Die  
Forgings (Hot-Pressed)

D 1248-84 (1989)

Standard Specification for  
Polyethylene Plastics Molding  
and Extrusion Materials

1.1.1.3 Federal Specifications (FS)

WW-U-531F

Unions, Pipe, Steel or  
Malleable Iron; Threaded  
Connection, 150 Lb and 250 Lb

1.1.1.4 Hanford Plant Standards (HPS)

I-5-1

Underground, Direct Burial  
Tubing Installation

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Approval Data List in this Section.

1.2.2 Vendor Information (VI): Submit information listed in Column 5 of Vendor Information List in this Section.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Tubing

1.3.1.1 Upon receipt of piping and tubing, and before storage, blow clean, using oil-free, dry air or nitrogen. Cap or cover the ends after cleaning.

1.3.1.2 Uncoil tubing in lengths only as needed; do not re-coil tubing.

1.3.1.3 Do not drag tubing across floors or surface that may damage surface of tubing.

1.3.1.4 Use open-end or tubing wrenches. Do not use adjustable wrenches.

1.3.2 Instruments

1.3.2.1 Tag all instruments with stainless steel tags marked with the instrument identification number prior to storage.

1.3.2.2 Store all instruments, electronics, and control panel in a clean, dry, heated environment. Connect any heaters provided with equipment.

1.4 FURNISHED EQUIPMENT: Equipment to be furnished for installation by Contractor is shown on the drawings.

1.4.1 Remote Control Module (RCM) - Install the RCM Cabinet where indicated on the drawings. Wiring from the Control Panel to the RCM as well as terminations will be by others.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Pressure, Flow, Fluid Characteristics, Measuring Instruments, and Control Devices: Provide instruments and control devices consisting of individual instrument loops of compatible devices specified in accordance with this Section and attached data sheets.

#### 2.1.2 24 VDC Power Supply

2.1.2.1 Provide a regulated 24 VDC power supply with the following requirements to power the two wire instrument loops.

1. 115 VAC input, 24 VDC  $\pm 0.1\%$  output
2. 1.0 ampere output minimum, current limited
3. Temperature rating: 32° to 130°F, operating
4. Enclosure for mounting inside control panel
5. Equal to Acopian #B24G110

#### 2.1.3 Graphics Display Panel

2.1.3.1 The graphics display panel to be installed on the front of the Control Panel shall be of a mosaic tile type construction with 1 inch squares. Frame shall be constructed of aluminum with steel structural support. Tiles shall be painted with appropriate colors to mimic the process flow. Indicating lights matching the tiles shall be installed with legends and colors as indicated on the drawing H-2-82752.

2.1.3.2 Graphic Display Panel shall operate on 115 VAC and be pre-wired to a terminal strip for field connection.

2.1.3.3 An alarm horn shall be included as an integral part of the Graphic Display Panel and shall also operate on 115 VAC.

2.1.3.4 Digital Panel Meters installed in the Graphics Display Panel shall be 4-1/2 digit LCD displays, operating on 115 VAC, and factory set to display the process variable in standard engineering units. Each display will be in a 4-20ma instrument signal loop. Reference the drawings and the instrument data sheets for the correct ranges and units. The Digital Display Meter shall be equal to Westcon Model 2471.

2.1.3.5 The Graphics Display Panel shall be equal to Ametek/Panalarm Model 280.

#### 2.1.4 Leak Detector System

2.1.4.1 The Controller shall be capable of monitoring up to six leak detector probes and provide a relay contact for each probe when moisture is detected. The Controller shall operate on 115 VAC, have integral indicating lights and alarm horn, and be capable of monitoring probes up to 2000 feet away. The Controller shall be surface mounted in a NEMA 12 enclosure.

2.1.4.2 The probes shall detect moisture around the tip and interface with the Controller specified above to provide an alarm condition in the presence of water. Probes shall have 1/2" MNPT threaded connections on both ends for installation and conduit connection. Wiring shall be as required for the system provided. One spare probe shall be provided in addition to the two probes to be installed.

2.1.4.3 The Leak Detector system shall be equal to Ryan Herco model 130C with model 141A probes.

#### 2.1.5 Motor Operated Valve Actuators

2.1.5.1 Each motor operated valve shall have a motor operator sized to operate the valve a full 90° during all process conditions. The actuator shall have factory pre-set cams and limit switches to interrupt power to the motor at full open or full closed positions. In addition each actuator shall have field adjustable cams with limit switches for independent valve position indication at the control panel. Enclosure for actuators shall be rated NEMA 4 and have a local position indication knob which rotates with the valve stem. Each valve shall operate on 115 VAC as will the indicating lights. Motor operated valves and flow control valves and level control valves shall have the actuator mounted and matched to the valve. Actuators shall be equal to Worcester Electric Actuator Series 75 #10755W-120A except actuator for Mov-9 shall be equal to PBM elective actuator ER-150-16-4-HA.

2.1.5.2 The two flow control valves shall, in addition to the actuator specified above, have a solid state electronic positioner to control the valve opening based on a 4-20 ma (24 VDC) analog input signal. Zero and span shall be field adjustable. Input signal impedance shall be 250 ohms or less. Positioner shall be compatible with the actuator furnished, be installed in the same enclosure. Positioners are used with FCV - 1 and FCV - 2 and shall be equal to Worcester AF17 positioner.

2.1.5.3 Valve FCV-3 shall have a battery backup installed to operate the valve to the closed position in the event of a power failure to the valve. The unit shall require a manual reset once normal power is restored. A manual operate switch shall also be provided to manually open the valve during a power failure. Batteries shall be sized to provide a minimum of 25 operations

on a full charge. Battery backup unit shall be furnished complete with battery charger and batteries in a NEMA 3R enclosure. Indicating lights shall be provided on the battery unit to give status, i.e. fully charged, charging, or trouble. Unit shall be equal to Worcester Controls series F75.

#### 2.1.6        Tubing, Valves, and Fittings

2.1.6.1       Provide in accordance with Pipe Codes.

2.1.6.2       Where anti-seize lubricant is required on male pipe threads, use pipe sealant with teflon on pipe threads and fittings. Loctite part No. 59290.

2.1.7        Wiring and other materials required to complete instrumentation installation are specified in Section 11300, Section 15496, Section 16400 and on the drawings.

### PART 3 - EXECUTION

#### 3.1        INSTALLATION

3.1.1        Install material and equipment in accordance with the drawings and manufacturer's instructions.

3.1.2        Cut tubing with tube cutter, then clean burrs and metal chips from ends. Blow clean with dry air or nitrogen, then re-cap or cover ends if not being installed immediately.

3.1.3        Bend tubing to radius as great or greater than minimum radius recommended by manufacturer. Use methods and equipment which produce bends free of wrinkles, bulges, kinks, or flat spots.

3.1.4        Install exposed tubing on straight parallel runs laid flat against supports. Space supports at 3 foot centers or as needed to prevent sagging. Gang tubes vertically wherever possible or support with tray. Stagger fittings on ganged runs as needed to prevent congestion.

3.1.5        Support tubing bundles as unit to prevent separation of tubes from bundles.

3.1.6        Provide expansion loops or slack as needed to prevent damage from expansion or contraction on tubing runs.

3.1.7        Use braze, solder, or weld type fittings specified in Pipe Codes for tubing runs which come into contact with process fluids.

3.1.8        Flushing

3.1.8.1 Flush instrument air lines with clean, dry, oil-free air or nitrogen before connecting to instruments. Test discharged air for cleanliness by blowing through clean white cloth over end of tube until cloth shows no visible trace of dirt, oil, or moisture.

3.1.8.2 Provide documented evidence that flushing has been accomplished in accordance with this Section. Deliver to KEH Acceptance Inspector before testing.

### 3.1.9 Calibration

3.1.9.1 Instruments to be installed will be calibrated by Westinghouse Hanford Company.

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 Pneumatic Tests

#### 3.2.1.1 Instrument sensing lines

a. Perform leak tests at test pressures shown on attached Pipe Codes.

b. Document leak/pressure testing of each system on "Leak/Pressure Test Certification" Form KEH-1757 (sample appended). Forms will be furnished by KEH Acceptance Inspector. Use 1 or more forms to describe and record each system. Under "Description" describe each system in enough detail to be readily correlated to shop fabrication drawings, or Contract Drawings as applicable. For systems tested segmentally, indicate continuity in "Description" to assure entire system has been tested.

c. Instrument sensing lines shall be leak tested in accordance with codes governing pipe or vessel to which they are attached.

### 3.2.2 Electrical Tests

3.2.2.1 Test instrument wiring in accordance with Section 16400 and following.

a. Test continuity of every wire from instruments or sensing elements to read-out or alarm device.

b. Measure and record resistance readings between shield and ground for shielded cables, in accordance with manufacturer's recommendations.

# PIPE CODE I-28

Service:	Max Operating Press:	Max Operating Temp:	Test Pressure:
Sampling	50 psig	100 F	70 psig

---

Sizes : 3/4" OD and Smaller

---

Tubing : Stainless steel, 0.035" min wall thickness, in accordance with  
: ASTM A 269, seamless, Grade TP 304L.

---

Fittings : Type 316 stainless steel, flared with Teflon seal, SSP Fittings  
: Corp Koncentrik.

---

Valves :  
Needle :Type 316 stainless steel, with Swagelok tube fitting ends, metal  
:to metal stem type, straight body pattern, orifice size of 0.172  
:("1" series), Viton A o-ring stem seal  
:  
:

---

④		Sonic FLOWMETERS				SHEET 1 OF 1		
						SPEC. NO.	REV.	
		NO	BY	DATE	REVISION	CONTRACT	DATE	
						REQ. NO.		
						BY	CHK'D	APP'D.
METERING ELEMENT	1	Meter Tag No.	FE-1 / FE-2 / FE-3			FE-4 / FE-5 / FE-6		
	2	Service	Influent sample			Effluent sample		
	3	Location	tank farm			tank farm		
	4	CONN'S.	Line Size, Sched.	1 1/2", 80			1 1/2" 80	
	5		Line Material	PVC			PVC	
	6		Connection Type	Flanged			Flanged	
	7		Connection Mat'l.	PVC			PVC	
	8	METER	Tube Material	PVC			PVC	
	9		Liner Material	N/A			N/A	
	10		Type	transit time			transit time	
	11		Meter Casing	STD			STD	
	12	FLUID	Power Supply	Elect. Code	115V	NEMA4	115V NEMA4	
	13		Grounding, Type & Matl.					
	14		Enclosure Class					
	15		Fluid	water			water	
	16	FLUID	Max. Flow, Units	75 GPM			75 GPM	
	17		Max. Velocity, Units					
	18		Norm. Flow	Min. Flow	20GPM	0 GPM	20GPM 0 GPM	
	19		Max. Temp.	Min. Temp.	90° F	40° F	90° F 40° F	
	20		Max. Press.	Min. Press.	50PSIG	15PSIG	50PSIG 15PSIG	
	21		Min. Fluid Conductivity					
	22		Vacuum Possibility					
	23							
	24	Instrument Tag Number	FE-1			FE-4 / FE-5 / FE-6		
	25	Function						
26	Mounting							
27	Enclosure Class							
28	Length Signal Cable							
29	Type Span Adjustment							
30	Power Supply	115V			115V			
31	TRANS.	Transmitter Output	4-20 ma			4-20 ma		
32								
33	DISPLAY	Scale Size	Range					
34		Chart Drive	Speed					
35		Chart Range	Chart No.					
36		Integrator						
37	CONTR.	Mode	Output					
38		Action	Auto-Man.					
39	ALARM	Contact No.	Form					
40		Rating	Elec. Code					
41		Action						
42	Manufacturer*	NUSONICS			NUSONICS			
43	Meter Model Number	8400			8400			
44	Instrument Model Number							

Notes:

\* Or Equal

ISA FORM S20





		LEVEL INSTRUMENTS (ULTRASONIC TYPE)				SHEET 2 OF 2		
		NO	BY	DATE	REVISION	SPEC. NO.	REV.	
						CONTRACT	DATE	
						REQ. - P.O.		
						BY	CHK'D	
							APPR.	
GENERAL	1. Tag Number	IE-1						
	2. Series	Influent sump level						
	3. Line No./Asset No.	T101						
	4. Application	Liquid Level						
	5. Function	Transmit						
PROBE	6. Model No.	SLADFA						
	7. Material	CPVC						
	8. Beam Angle	12°						
	9. Style	continuous						
	10. Length	5-3/4 NPT						
AMPLIFIER	11. Connection	2" NPT						
	12. Range Int./Size	CPVC 1 4"						
	13. Compensation	Temp Velocity						
	14. Location	Integral						
	15. Excitation	NEMA 4						
TRANS.	16. Conduit Connection	3/4" NPT						
	17. Output	4 ZOMA						
	18. Range							
	19. Span							
	20. Max Zone	1 FOOT						
OPTIONS	21. Power	120 VAC						
	22. Cable							
	23. Level Indicator							
	24. Alarm							
	25. Material	water						
SERVICE	26. Foam/Spray	none						
	27. Pressure Max./Normal	PSIG PSIG						
	28. Temp. Max./Normal	80°F 40°F?						
	29. Manufacturer	SENSAL						
	30. Model	89SC-T						
Notes:								

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		DIFFERENTIAL PRESSURE INSTRUMENTS				SHEET <u>1</u> OF <u>2</u>	
		NO	BY	DATE	REVISION	SPEC. NO.	REV. A
						CONTRACT	
						REQ. P.O.	
						BY	CHK'D APPR.
1		Tag No. _____ Service _____					
GENERAL	2	Function <input type="checkbox"/> Record <input type="checkbox"/> Indicate <input type="checkbox"/> Control <input type="checkbox"/> Blind <input type="checkbox"/> Trans <input type="checkbox"/> Integ <input type="checkbox"/> Other _____					
	3	Case <input type="checkbox"/> MFR STD <input type="checkbox"/> Nom Size _____ Color: <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	4	Mounting <input type="checkbox"/> Flush <input type="checkbox"/> Surface <input type="checkbox"/> Yoke <input type="checkbox"/> Other _____					
	5	Enclosure Class <input type="checkbox"/> General Purpose <input type="checkbox"/> Weather proof <input checked="" type="checkbox"/> Explosion proof <input type="checkbox"/> Class _____					
	6	Power Supply <input type="checkbox"/> For use in Intrinsically Safe System <input type="checkbox"/> Other _____					
	7	Chart <input type="checkbox"/> 117V 60 Hz <input type="checkbox"/> Other ac _____ dc @ <u>24</u> Volts _____					
	8	Chart Drive <input type="checkbox"/> 12 in. Circ. <input type="checkbox"/> Other _____ Range _____ No. _____					
	9	Scale <input type="checkbox"/> 24 hr <input type="checkbox"/> Other _____ Elec. <input type="checkbox"/> Spring <input type="checkbox"/> Other _____					
	9	Type _____ Range: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 _____					
XMTR	10	Transmitter Output <input type="checkbox"/> 4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> -21-103 kPa (3-15 psig) <input type="checkbox"/> Other _____ For Receiver, See Spec Sheet _____					
CONTROLLER	11	Control Modes <input type="checkbox"/> P=Prop (Gain), <input type="checkbox"/> I=Integral (Auto Reset), <input type="checkbox"/> D=Derivative (Rate) Sub: <input type="checkbox"/> s=Slow, <input type="checkbox"/> f=Fast <input type="checkbox"/> I <input type="checkbox"/> D <input type="checkbox"/> P <input type="checkbox"/> PI <input type="checkbox"/> PD <input type="checkbox"/> PID <input type="checkbox"/> I <sub>2</sub> <input type="checkbox"/> D <sub>2</sub> <input type="checkbox"/> Other _____					
	12	On Meas. Increase Output: <input type="checkbox"/> Increases <input type="checkbox"/> Decreases <input type="checkbox"/> _____					
	13	Auto-Man Switch <input type="checkbox"/> None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	14	Set Point Adj. <input type="checkbox"/> Manual <input type="checkbox"/> External <input type="checkbox"/> Remote <input type="checkbox"/> Other _____					
	15	Manual Reg. <input type="checkbox"/> None <input type="checkbox"/> MFR STD <input type="checkbox"/> Other _____					
	16	Output <input type="checkbox"/> 4-20 mA <input type="checkbox"/> 10-50 mA <input type="checkbox"/> 21-103 kPa (3-15 psig) <input type="checkbox"/> Other _____					
UNIT	17	Service <input type="checkbox"/> Flow <input type="checkbox"/> Level <input type="checkbox"/> Diff. Pressure <input type="checkbox"/> Other <input type="checkbox"/> Gage _____					
	18	Element Type <input type="checkbox"/> Diaphragm <input checked="" type="checkbox"/> Bellows <input type="checkbox"/> Mercury <input type="checkbox"/> Other _____					
	19	Material <input type="checkbox"/> Body <u>CARBON STEEL</u> <input type="checkbox"/> Element <u>STAINLESS STEEL</u> _____					
	20	Rating <input type="checkbox"/> Overrange _____ Body Rating <u>2000</u> psig _____					
	21	Diff. Range <input type="checkbox"/> Fixed <input type="checkbox"/> Adj. Range <u>0-20 PSI</u> <input type="checkbox"/> Set At <u>0-15 PSI</u> _____					
	22	Elevation <u>0</u> _____ Suppression <u>0</u> _____					
	23	Process Data <input type="checkbox"/> Fluid <u>WATER</u> <input type="checkbox"/> Max Temp. <u>80° F</u> <input type="checkbox"/> Max. Press. <u>15 PSI</u> _____					
	24	Process Conn. <input type="checkbox"/> 1/2 in. NPT <input type="checkbox"/> Other <u>1 in. NET STAINLESS STEEL</u> _____					
25	Alarm Switches _____ Quantity _____ Form _____ Rating _____						
26	Function <input type="checkbox"/> Meas. Var. <input type="checkbox"/> Deviation <input type="checkbox"/> Contacts To _____ on Inc. Meas. _____						
	27	Options <input type="checkbox"/> Pressure Element <input type="checkbox"/> Range _____ Material _____ <input type="checkbox"/> Temp. Element <input type="checkbox"/> Range _____ Type _____					
	<input type="checkbox"/> Filt Reg. <input type="checkbox"/> Sup. Gage <input type="checkbox"/> Output Gage <input type="checkbox"/> Charts _____						
	Valve Manifold <u>STAINLESS STEEL DRAIN AND VENT VALVES</u> _____						
	<input type="checkbox"/> Cond. Pots <input type="checkbox"/> Adj. Damp <input type="checkbox"/> Integral Sq. Rt. Ext. <input type="checkbox"/> _____						
	Integrator _____						
	Other <u>SILICON FILL FLUID</u> _____						
28	MFR & Model No. <u>ROSEMOUNT # GP 5 E 12 B102</u> _____						
Notes:							

[illegible]

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Project or W O No	Title	Dwg Reference	Test Procedure/Rev		
Construction Spec./Rev	Code or Standard	Year	Addenda	Class	Stamp Required <input type="checkbox"/> Yes <input type="checkbox"/> No

Description of System or Component(s) Test Boundaries

## TEST PREPARATION

<b>Notification Requirements</b> <input type="checkbox"/> Quality Control <input type="checkbox"/> Acceptance Inspection <input type="checkbox"/> Safety Engineer <input type="checkbox"/> Client _____ <input type="checkbox"/> Authorized Inspector <input type="checkbox"/> _____	<b>Valve Line-up Requirements (for permanent valves installed)</b> Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close
--	--

Required Test Medium Medium _____	Required Test Medium Temp. Temp. _____	Flushing Requirements Flushing _____	<input type="checkbox"/> Blue Chalking Required <input type="checkbox"/> Soap Solution Required
--------------------------------------	---	---	--

Design System Pressure _____	Design Test Pressure _____	Specified Hold Time _____	Prepared By _____	Date _____
---------------------------------	-------------------------------	------------------------------	-------------------	------------

## PRETEST CHECKLIST

Item or Requirement	Craft Supervision	Quality Control	
		Accept	Date
Valve line-up per design requirements (see above line up)			
Flushing of system and/or component completed per design requirements			
All lines or components not to be tested are properly isolated or disconnected.			
Vents and openings checked; proper Pressure Relief Valve installed and discharge checked			
Test medium per design requirements; temperature equalized. Medium _____ Medium Temp. _____ (ASME only)			
Test gauge(s) correct range and currently calibrated. SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____			
Pressure Relief Valve properly set and currently calibrated. SN _____ PSI Set _____ Checked Date _____ SN _____ PSI Set _____ Checked Date _____ SN _____ PSI Set _____ Checked Date _____			

## TEST PERFORMANCE

Item or Requirement		Quality Control	
		Accept	Date
ROUTINE and other if specified:			
50% Tp obtained and examination conducted	= Tp _____		
Pressure increments at 0-10 Tp:	= Tp _____		
	= Tp _____		
	= Tp _____		
	= Tp _____		
	= Tp _____		
Hydrostatic testing - areas to be inspected chalked prior to application of pressure.			
Hydrostatic testing - examination conducted while system/component pressurized. Specified Tp _____ PSI obtained at _____ a.m. p.m.			
Pneumatic Testing - soap solution applied to areas to be tested and system/components examined while pressurized. Specified Tp _____ PSI obtained at _____ a.m. p.m.			
Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Quality Control Signature	Stamp or PR No.	Date

## INSPECTION VERIFICATION

Documentation properly prepared.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Actual T <sub>p</sub> during final inspection _____ PS
All joints and welded attachments to pressure retaining components chalked/soaped as applicable	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
All joints and welded attachments to pressure retaining components visually inspected for leakage.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Specified hold time verified at _____ a.m. p.m.
Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Acceptance Inspection Signature		Stamp or PR No. .
			Date

**OTHER**

Comments

NCR (if applicable)	Client Representative		Date
	Witness - ASME Authorized Inspector		Date
<input type="checkbox"/> Document Reviewed <input type="checkbox"/> Drawings Highlighted	Construction Engineering	PR No.	Date



13440.H03

13440-20

5/91

Project No R-680H-C2		APPROVAL DATA LIST ("X" Indicates Required Data)											
Project Title PEP LIQUID WASTE TREATMENT FACILITY													
Specification Section 13440													
1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 DATA								6 REMARKS	
				Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts		Installation Instructions
	ULTRASONIC LEVEL SENSOR AND XMTR						X	X	X	X	X	X	
	CAPACITIVE PROBE LEVEL XMTR						X	X	X	X	X	X	
	FLOAT LEVEL SWITCH						X	X	X	X	X	X	
	MAGNETIC FLOWMETERS						X	X	X	X	X	X	
	SONIC FLOWMETERS						X	X	X	X	X	X	
	DIFFERENTIAL PRESSURE XMTR'S						X	X	X	X	X	X	
	PH XMTR AND SENSOR						X	X	X	X	X	X	
	CONDUCTIVITY XMTR AND SENSOR						X	X	X	X	X	X	
	FLOW SWITCHES						X	X	X	X	X	X	
	GRAPHIC DISPLAY PANEL				X		X		X		X		
	DIGITAL PANEL METERS						X	X	X	X	X	X	
	LEAK DETECTOR						X	X	X	X	X	X	
	VALVE ACTUATORS						X	X	X	X	X	X	

Project NoB-680H-C2

Project Title PFP LIQUID WASTE TREATMENT FACILITY

Specification Section 13440

## VENDOR INFORMATION LIST

("X" Indicates Required Data)

1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 VENDOR INFORMATION (VI)										
				Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Circuit or Control Diagram	Instructions			Spare Parts List	Data Sheets	Illustrative Cuts
									Installation	Operation	Maintenance			
	ULTRASONIC LEVEL SENSOR AND XMTR						X	X	X	X	X	X	X	X
	CAPACITIVE PROBE LEVEL XMTR						X	X	X	X	X	X	X	X
	FLOAT LEVEL SWITCH						X	X	X	X	X	X	X	X
	MAGNETIC FLOWMETERS						X	X	X	X	X	X	X	X
	SONIC FLOWMETERS						X	X	X	X	X	X	X	X
	DIFFERENTIAL PRESSURE XMTR						X	X	X	X	X	X	X	X
	PH XMTR AND SENSOR						X	X	X	X	X	X	X	X
	CONDUCTIVITY XMTR XSENSOR						X	X	X	X	X	X	X	X
	FLOW SWITCHES						X	X	X	X	X	X	X	X
	GRAPHIC DISPLAY PANEL			X				X				X		X
	DIGITAL PANAL METERS							X		X	X	X	X	X
	LEAK DEFECTOR						X	X	X	X	X	X	X	X
	VALVE ACTUATORS							X	X	X	X	X	X	X

13440.H03

END OF SECTION

5/91

SECTION 15300  
FIRE PROTECTION

**PART 1 - GENERAL**

**1.1 REFERENCES**

**1.1.1 Reference Standards and Specifications:** The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

- |                |   |   |
|----------------|---|---|
| <b>1.1.1.1</b> | American Welding Society (AWS)<br><br>AWS D1.1-90   | <br><br>Structural Welding Code-Steel   |
| <b>1.1.1.2</b> | Factory Mutual System (FM)<br><br>1991 Edition  | <br><br>Approval Guide  |
| <b>1.1.1.3</b> | Federal Specifications (FS)<br><br>TT-S-00230C, 1970<br>Including AMD 2 1970                        | <br><br>Sealing Compound: Elastomeric<br>Type, Single Component (For<br>Caulking, Sealing, And Glazing<br>In Buildings And Other<br>Structures) |
| <b>1.1.1.4</b> | Federal Standards (FED STD)<br><br>FED-STD-595B 1989  | <br><br>Colors Used in Government<br>Procurement  |
| <b>1.1.1.5</b> | International Conference of Building Officials (ICBO)<br><br>1988 Edition                           | <br><br>Uniform Building Code (UBC)   |
| <b>1.1.1.6</b> | National Fire Protection Association (NFPA)<br><br>NFPA 13  | <br><br>Standard for the Installation<br>of Sprinkler Systems,<br>1991 Edition  |
| <b>1.1.1.7</b> | Underwriters Laboratories, Inc (UL)<br><br>1991, Including Supplement<br>1991, Including Supplement | <br><br>Building Materials Directory<br><br>Fire Protection Equipment<br>Directory  |
| <b>1.1.1.8</b> | Washington Administrative<br>Code (WAC), Title 212  | Community Development<br>Chapter 212-80, Fire<br>Sprinkler System Contractors   |

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Approval Data List in this Section.

1.2.2 Vendor Information (VI): Submit information listed in Column 5 of Vendor Information List in this Section.

1.2.3 Design/Fabricator Drawings: Submit design, fabrication and installation drawings of wet pipe sprinkler system. Design in accordance with NFPA 13 for ordinary hazard, group 2, occupancy classification. Size system in accordance with hydraulic calculation method in NFPA 13, Section 6-2, 6-3 and 6-4. The design shall have a flow and pressure that is a minimum of 10 percent below the water supply curve. Available water supply for system design shall be verified with Hanford Fire Department before design. Current flow data is available, upon written request, from Hanford Fire Department.

1.2.3.1 Identify location of hangers, supports and sway braces on design drawing. Provide details of hanger, support and sway brace assemblies, to identify the assembly components used, including material type, sizes, and manufacturer's name, model or figure number as applicable. Include on the design drawing sufficient detail of attachment of assembly to building structure, showing fastener type, size, material and embedment depth where applicable.

1.2.3.2 Design attachment of hangers, supports and sway braces to building structure shall meet the requirements of UBC, Zone 2B, 1988. Submit detailed mathematical analysis of attachment designs.

1.2.3.3 Design of the sprinkler system shall comply with the earthquake requirements of NFPA 13, Section 4-5.4.3 and associated NFPA 13 Appendix A references.

1.2.3.4 Identify proposed deviations from specified materials or design requirements in writing.

1.2.3.5 Design shall be prepared under the supervision of, reviewed and approved by a Washington State licensed Professional Fire Protection Engineer to verify that the design complies with the requirements of NFPA 13 and construction specifications. The submitted drawings shall bear the engineer's professional stamp.

1.2.3.6 The design shall be prepared by a Level 3 Fire Sprinkler Certificate of Competency holder and installed by a fire protection sprinkler contractor holding a Washington State Level 3 license in accordance with WAC 212-80. Calculations: Submit calculations in design report format. Each set of calculations shall be referenced to detail drawings, if applicable, which show completed design. As a minimum, the following calculations shall be provided:

- a. Design criteria and stress analysis of structural members.
- b. Hydraulic calculations for the fire sprinkler system.
- c. Seismic design: Submit calculations and details for equipment and component installation/mountings to resist seismic forces in accordance with

NFPA 13, for anchoring and attachment of fire sprinkler system components, hanger, supports, and sway braces.

1.2.4 Record Drawings: Submit drawings of wet pipe sprinkler system as installed.

1.2.5 NFPA Test Certificate: Complete Contractor's Material and Test Certificate, in accordance with NFPA 13, Section 8-1 by a State of Washing Level 3 Certificate Competency holder.

### 1.3 SYSTEM DESCRIPTION

1.3.1 Sprinkler system shall include standard trim including fire department connection check valve, flow alarm switch, system main drain valve, pressure gauge, and electric alarm bell approved for outdoor use.

1.3.2 Components of sprinkler system, if not designated in this Section and the Drawings by manufacturer's name and model/figure number, shall be current products of manufacturer and UL listed or FM approved for use intended.

### 1.4 QUALITY ASSURANCE

1.4.1 Welding Documentation: Fabricator shall ensure that welders in his employ are qualified in accordance with AWS requirements before performing shop or field welding on structural steel components which are part of this Section. Welder qualification test results shall be made available upon request. Proposed AWS welding procedures shall be subject to review. Prior to welding, fabricator shall have a welding procedure and a quality assurance procedure as required by NFPA 13, Paragraph 2-5.2.8.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Piping

2.1.1.1 Pipe and fittings: Meet the requirements of NFPA 13. Piping shall be steel with threaded or grooved type (rubber gasketed) fittings. Rubber gasketed fittings for use with plain end pipe shall not be used.

2.1.1.2 Flexible couplings: Bolted sleeve type for use with grooved-end pipe, with rubber rings for sealing.

2.1.2 Reducers: 1 piece concentric threaded reducers or reducing tees for straight run reduction in pipe sizes. Grooved type, rubber gasketed reducing couplings, and hexagonal or face bushings shall not be used without approval of KEH Field Contract Engineer.

2.1.3 Identification Labels: Approximately 2-1/4 inches by 14 inches bearing words "FIRE PROTECTION WATER" and direction arrow approximately 2-1/4 inches by 7 inches. Labels shall have adhesive backing.

#### 2.1.4 Expansion Anchors

2.1.4.1 For concrete: Wedge type anchors, Kwik Bolt II, manufactured by Hilti Fastening Systems, or approved substitute. Install in accordance with manufacturer's recommendations.

2.1.4.2 For filled concrete blocks: Sleeve type, Hol-Hugger manufactured by Hilti Fastening Systems, or Red Head Sleeve Anchor manufactured by Phillips Drill Company. If open cells are contacted, use toggle bolts.

2.1.5 Sealant

2.1.5.1 Room temperature vulcanizing (RTV) silicone foam, Dow Corning type 3-6548.

2.1.5.2 Light-colored, polysulfide-base compound, meeting the requirements of FS TT-S-00230, Type II.

2.1.6 Paint: See Section 09900.

2.2 EQUIPMENT: All equipment shall meet or exceed requirements set forth by the Factory Mutual System (1991 Edition) Approval Guide.

2.2.1 Electric Alarm Bell: Weatherproof electrical bell with hood.

2.2.2 Switches

2.2.2.1 Furnish valve position supervisory switches to supervise OS & Y gate valves as shown on the Drawings. Switches shall be tamperproof, alarms when cover is removed, and alarm during first 2 revolutions of valve handwheel in closing direction. Switches shall be single-pole, double throw, 120V ac, rated for pilot duty and provided with suitable mounting hardware. Coordinate with BP.02 on equipment schedule drawing H-2-82751.

2.2.2.2 Flow switches installed directly on sprinkler system piping flow shall be flexible vane type, Potter Electric Model VSR-F, with single pole double throw contacts. It shall be instantly recycling with retard trip adjustable 0-75 seconds.

2.2.3 Automatic Sprinklers: Nominal 1/2 inch diameter orifices, rated for 165°F temperature, unless other temperature ratings are required by NFPA 13.

2.2.4 Sprinkler Head Guards: Formed wire or forged steel, suitable for use with upright or pendent sprinklers, which can be attached or removed without disturbing sprinkler head.

2.2.5 Sprinkler Cabinet: Provide with required number of sprinkler heads of ratings and types installed, a sprinkler wrench, and locate adjacent to riser.

2.2.6 Fire Department Connection: Brass finish and furnished with self-closing double clappers, plugs and chains, automatic ball-drip valve, and escutcheon plate. Connection shall be 4 inch IP by 2-1/2 inch HT by 2-1/2 inch HT. Hose threads shall be National Standard Fire Hose threads, 7-1/2 TPI.

2.2.7 Backflow Preventor: The six (6) inch double-check back flow preventor assembly shall be approved by Washington State Department of Health with electrically supervised outside screw and yoke gate valves at each end of double-check valve.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

3.1.1 Install wet pipe sprinkler system in accordance with NFPA 13 for ordinary hazard occupancy, group 2, classification.

3.1.2 The new sprinkler riser shall be fed from a new 6 inch cement-lined, ductile iron, underground fire main connected to an existing 8 inch supply water line located on the south side of the proposed building. The fire main shall be capped five feet outside building for future connection by others. A 6 inch sprinkler system riser shall be located in the process area. The riser shall include a double-check backflow preventor assembly, approved by Washington State Department of Health, electrically supervised outside screw and yoke gate valves at each end of the double-check valve, check valve, flow switch, and siamese connection.

3.1.3 Route piping as high as possible exposed below suspended ceiling. Coordinate piping and sprinkler head location with the lighting fixture layout. Do not install piping and sprinkler heads under light fixtures.

3.1.4 Install vane type flow switch to provide a single zone annunciation.

3.1.5 Coordinate requirements for interruption of existing services and Fire Department stand-by with KEH Field Contract Engineer.

3.1.6 Protect new piping from damage by earthquake, by proper clearance around penetration holes, flexible couplings, and sway bracing, in accordance with NFPA 13, Sections 4-5.4.3 and A-4-5.4.3

#### **3.1.7 Sealing Floor and Wall Penetrations**

##### **3.1.7.1 Nonfire rated**

a. Cut minimum size hole for pipe passing through gypsum board walls. Seal both sides with polysulfide sealant.

b. Pack pipe penetrations through concrete floors and walls with fiberglass or mineral wool packing and seal both sides with minimum 1 inch thick polysulfide sealant.

c. Seal pipe penetrations through concrete block walls both sides to thickness of web with polysulfide sealant. Provide fiberglass or mineral wool packing as required to prevent filling void.

3.1.8 Pipe Escutcheons: Install on sides of wall penetrations exposed to view.

3.1.9 Repair damaged surfaces. Refinish repaired or defaced surfaces to match adjacent undisturbed areas.

3.1.10 Terminate exterior discharge, inspectors test, and auxiliary drain lines with 45 degree elbows, turned down.

3.1.11 Provide suitable splash-pads at exterior discharge locations.

3.1.12 Install sprinkler head guards where subject to mechanical damage from low elevation or exposure to normal building activities.

3.1.13 Paint new system piping exposed to view, with 1 coat of zinc chromate primer and 1 coat of semigloss enamel. Finish color shall be red (No. 21105) shown in FED STD 595. Surface preparation, including cleaning and primer, shall be in accordance with Section 09900.

3.1.14 Welding

3.1.14.1 Limit welding to fabrication of supports or braces, if necessary. No other on site welding will be permitted, except as specified in this Section or on the Drawings.

3.1.14.2 Perform welding of steel structural elements in accordance with AWS D1.1.

3.1.14.3 Do not perform welding or flame cutting on or within building without written approval of KEH Field Contract Engineer.

3.1.14.4 KEH will perform visual weld examination in accordance with AWS D1.1 paragraph 6.5.5.

3.1.15 Hangers and Supports

3.1.15.1 Hang, support and brace sprinkler system piping from building structural steel members, concrete surfaces, or to metal supports attached to building structure or concrete surfaces in accordance with NFPA 13.

3.1.15.2 Use clamping devices when attaching to structural steel. When clamping is impracticable, obtain written authority to weld, punch, drill or cut structural steel members to provide attachment.

3.1.15.3 When required, deliver to KEH Field Contract Engineer detailed mathematical analysis, by registered professional engineer, of structural integrity where questionable alteration of building structural components are proposed. Analysis may also be required where obvious deformation of structural members are caused by hanging sprinkler piping.

3.1.16 Identification Labels

3.1.16.1 Install labels after painting is completed.

3.1.16.2 Locate labels on pipe where they can be easily read. Place labels on bottom quadrant of overhead pipe and top quadrant of pipe lower than eye level.



3.1.16.3 Identify only feed mains, cross mains, and risers 3 inch nominal diameter and larger.

3.1.16.4 Locate line identification at intervals of approximately 40 feet on unobstructed runs, and on each side of partitions and floors.

3.1.16.5 Identification of piping system shall conform to requires in Section 15493, Appendix "A".

3.1.16.6 Identification of valves shall be with standard brass, valve tags (1-1/2" Diameter minimum) with pure brass chain and brass "s" hooks.

3.1.17 Signs: Permanent type identification signs shall be installed at control, drain, test, and alarm valves. Legend shall include warning of Fire Department response to operation of valve.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Flushing and Testing

##### 3.2.1.1 General

a. Furnish equipment and instruments required to perform flushing and testing operations described below.

b. Conduct testing operations while witnessed by KEH Acceptance Inspector.

c. Remove and replace pieces of apparatus, material, or work which fails in flushing or testing operations and retest.

d. Repair damage resulting from flushing or testing to satisfaction of KEH Field Contract Engineer.

##### 3.2.1.2 Hydrostatic test

a. Hydrostatically test new sprinkler system in accordance with NFPA 13, Section 8-2.2 and A-8-2.2.

b. Use hydrostatic test pressure of 200 psi.

c. Leaks in piping and loss of pressure during the test will not be acceptable.

**Specification Section 15300**

**("X" Indicates Required Data)**

[illegible]

**("X" Indicates Required Data)**

## SECTION 15400

### PLUMBING

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.2 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American Society of Mechanical Engineers (ASME)

ASME B16.22-1989

Wrought Copper and Copper Alloy  
Solder Joint Pressure Fittings

ASME B16.3-1985

American National Standard  
Malleable Iron Threaded  
Fittings, Classes 150 and 300

##### 1.1.1.2 American Society for Testing and Materials (ASTM)

A 53-90a

Standard Specification for  
Pipe, Steel, Black and  
Hot-Dipped, Zinc-Coated Welded  
and Seamless

B 88-89

Standard Specification for  
Seamless Copper Water Tube

D 1784-90

Rigid Polyvinyl Chloride (PVC)  
Compounds and Chlorinate  
Polyvinyl Chloride (CPVC)  
Compounds

D 2657-90

Standard Practice for Heat  
Joining Polyolefin Pipe and  
Fittings

D-4101-82 (1988)

Standard Specification for  
Propylene Plastics Injection and  
Extrusion materials

##### 1.1.1.3 American Water Works Association (AWWA)

C651-86

AWWA Standard for Disinfecting  
Water Mains

##### 1.1.1.4 International Association of Plumbing and Mechanical Officials (IAPMO)

1988 Edition

Uniform Plumbing Code (UPC)

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Approval Data List in this Section.

1.2.2 Vendor Information (VI): Submit information listed in Column 5 of Vendor Information List in this Section.

### 1.3 DELIVER, STORAGE, AND HANDLING

1.3.1 Preserve identity of pipe and tube from time of receipt on site until installation is complete. Store pipe and tube of different material specifications and grades separately.

1.3.2 When pipe or tube is removed from bundle and cut, return remaining piece to bundle or clearly and permanently mark. Do not remove manufacturer's identifying tags from bundles of pipe.

1.3.3 When pipe type or tube identifying mark is cut from length of pipe, re-mark remaining section clearly and permanently. Use either original marking or field code symbol for each grade of pipe or tube.

1.3.4 KEH may inspect piping materials for compliance with above storage and control procedures.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Pipe, Tubing, and Fittings: Specified in Pipe Codes and detailed on the Drawings.

2.1.2 Sealants for Threaded Piping Joints: Teflon type tape, similar to Scotch Brand Pipe Sealant Tape No. 547; Chemtrol Dri-Seal No. 5; or Crane Packing Co "Thread-Tape".

#### 2.1.3 Supports

2.1.3.1 Hangers and Supports: Hangers specified below show requirements for supports. Numbers in tabulations refer to Grinnell Corporation figures. Perforated straps shall not be used for supporting piping.

2.1.3.2 Pipe Supports: Provide Unistrut type supports and accessories (wide flange clamps, pipe clamps, nuts, bolts, lock washers, and flat washers).

## PIPE HANGERS AND SUPPORTS

Piping To Be Supported	Support Type	Hanger Rod
P-1	Adjustable, tubing ring, Figure 104, CT-99C	3/8 inch threaded rod and Figure 128R Flange

### 2.1.4 Pipe Penetration Materials

2.1.4.1 Sealer for floor penetrations: Similar to WR Grace "Hornflex", Dap "Flexiseal", or PRC 5000.

2.1.4.2 Floor and ceiling plates: Chrome-plated, spring-loaded type.

### 2.1.5 Pipe Insulation

2.1.5.1 Interior sanitary cold water: 1 inch thick similar to Manville Flame-Safe fiberglass with average thermal conductivity not to exceed 0.22 Btu in/hr ft<sup>2</sup> F at mean temperature of 75 F. Accessories, such as adhesives, mastics, cements, tapes, and cloth for fittings shall have same component ratings as given above.

2.1.5.2 Jacketing: Laminate of white kraft and foil reinforced with glass and applied to insulation at factory. Jackets shall have minimum 1-1/2 inch longitudinal sealing lap. Butt joints sealed with 3 inch wide strip of jacket material. Longitudinal jacket laps and butt strips secured with adhesive recommended by insulation manufacturer.

2.1.5.3 Fittings and valves: Same type used for pipe. Open-weave fiberglass tape or cloth used where necessary to hold insulation in place.

## 2.2 EQUIPMENT

2.2.1 Ratings and sizes establish minimum requirements for equipment.

2.2.2 Plumbing Fixtures: See drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 General

3.1.1.1 Fabricate and install piping and tubing in accordance with the UPC, the Pipe Codes, the Drawings, and this Section.

3.1.1.2 Report conflicts in design locations of piping with ductwork, lighting fixtures, etc., to KEH.

3.1.1.3 Keep piping systems clean during work. Once fabrication has started on length of pipe and tubing, keep open ends plugged or capped when installation is not in progress to prevent entry of dirt and other foreign materials.

3.1.1.4 Remove burrs from mating threads in threaded piping before assembly. Ream pipe to nominal inside diameter after cutting.

3.1.1.5 Seal floor and wall penetrations air and watertight with specified sealant.

3.1.1.6 Install floor and ceiling plates at piping penetrations.

3.1.1.7 Prepare piping connections to equipment with flanges or unions.

3.1.1.8 Provide non-conducting dielectric connections wherever jointing dissimilar metals.

3.1.1.9 Route piping and tubing in orderly manner and maintain gradient.

3.1.1.10 Install piping and tubing to conserve building space and not interfere with use of space.

3.1.1.11 Group piping and tubing whenever practical at common elevations.

3.1.1.12 Install piping and tubing to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

3.1.1.13 Provide clearance for installation of insulation and access to valves and fittings.

3.1.1.14 Slope water piping and arrange to drain at low points.

3.1.1.15 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to weldment.

3.1.1.16 Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 09900.

3.1.1.17 Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

3.1.1.18 Excavate in accordance with Section 02200 and for work of this Section.

3.1.1.19 Backfill in accordance with Section 02200 for work of this Section.

3.1.1.20 Install valves with stems upright or horizontal, not inverted.

3.1.1.21 Clean piping or insulation and provide identification in accordance with ANSI A13.1. Identification shall be a maximum of 20 feet apart.

### 3.1.2 Soldering of Copper Water Tubing

3.1.2.1 Filler metal. The solder shall be lead-free and melt and flow freely within the desired temperature range and, in conjunction with a suitable flux, shall wet and adhere to the surfaces to be joined.

3.1.2.2 Flux. A flux that is fluid and chemically active at soldering temperature shall be used to eliminate oxidation of the filler metal and the surfaces to be joined and to promote free flow of solder.

3.1.2.3 Surface Preparation. The surfaces to be soldered shall be clean and free from grease, oxides, paint, scale, and dirt of any kind.

3.1.2.4 The clearance between surfaces to be joined shall be no larger than necessary to allow complete capillary distribution of the filler metal.

3.1.2.5 Soldering Procedure. Solderers shall follow the procedure in the Copper Tube Handbook of the Copper Development Association.

3.1.2.6 To minimize oxidation, the joint shall be brought to soldering temperature in as short a time as possible without localized underheating or overheating.

3.1.2.7 Flux Removal. Residual flux shall be removed.

### 3.1.3 Double Containment Polypropylene Soil Piping

3.1.3.1 Protect against impact shocks and dropping. Before laying, inspect pipe and discard damaged sections.

3.1.3.2 Start laying in finished trenches at lowest point of run and progress upgrade with spigot ends pointed in direction of flow. Support full length of piping.

3.1.3.3 Center joints so pipeline with uniform invert is formed.

3.1.3.4 Set pipe to resist deformation, according to line and grade, preparatory to making joints.

### 3.1.4 Hangers and Supports

3.1.4.1 Support vertical piping at least once each 12 feet of run.

3.1.4.2 Locate supports at maximum spacing of 6 ft. for 1 1/2" or smaller copper tube, 10 ft. for 2" copper tube, with additional supports close to concentrated loads such as valves and specialties.

3.1.4.3 Prime and paint all hangers and supports with two coats of enamel gray paint.

### 3.1.5 Flushing

3.1.5.1 Obtain approval for disposal of flushing water from KEH.



3.1.5.2 Flush piping with water, before leak testing, until effluent is clear and contains no visible particulate matter, but in no case for less than 1 minute.

3.1.5.3 Raw water may be used for flushing sanitary waste, vent and drain lines. Use cold sanitary water for flushing cold water lines. Flush sanitary water lines before disinfecting.

3.1.5.4 Flow for flushing shall be sufficient to produce velocity of at least 5 feet per second with pipe full.

3.1.5.5 Remove water from lines after flushing is completed.

3.1.5.6 Provide documented evidence that flushing has been accomplished in accordance with this Section. Deliver to KEH before leak/pressure testing.

3.1.6 Perform leak/pressure testing in accordance with Paragraph 3.2.1.

3.1.7 Pipe Insulation

3.1.7.1 Where required, insulate bends, fittings, flanges and valves of piping system. Install to thickness for piping.

3.1.7.2 Do not apply until systems have been leak tested.

3.1.7.3 Apply insulation to uniform thickness for each pipe size and piece of equipment and fit to surface to which applied.

3.1.7.4 Apply molded pipe covering with end joints butted together. Remove insulation not properly fit and replace.

3.1.7.5 Surfaces shall be clean, dry, and free of moisture, oil, dirt, scale, loose rust, or other foreign material, before layers of insulation are applied.

3.1.7.6 Groove and score insulation where necessary to fit contours of equipment.

3.1.7.7 Where pipe hangers are attached directly to pipe by clamps, cover clamps, removing part of inside surface of insulation, when necessary, to maintain continuous unbroken outer surface of pipe covering. Seal insulation around hanger clamp with finish cement.

3.1.7.8 Install insulation in neat, uniform manner. Seal ends of insulation with cement or with specially-prepared ends supplied with insulation.

3.1.7.9 Insulation shall be continuous through wall and other openings and through pipe sleeves.

3.1.8 Pipe Identification: Identify as to service and direction of flow, in accordance with ANSI A13.1. See Section 15493, Appendix "A".

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Visual Examination:

##### 3.2.1.1 Copper Water Tubing - Soldered joints.

Limitations on imperfections in soldered joints are as follows:

(a) There shall be no visible evidence of excessive overheating.

##### 3.2.1.2 Plastic Piping - Heat fusion joints.

Limitations on imperfections in heat fusion joints are as follows:

(a) Internal protrusion shall not exceed 25% of wall thickness.

(b) There shall be no visible unfilled or unbonded areas.

#### 3.2.2 Hydrostatic Testing: Perform as designated in applicable Pipe Codes.

##### 3.2.2.1 Furnish instruments, facilities, and labor required to conduct tests.

##### 3.2.2.2 Obtain approval for disposal of water used for testing from KEH.

##### 3.2.2.3 Verify air has been expelled from piping before applying hydrostatic pressure.

##### 3.2.2.4 Perform testing in presence of and to satisfaction of KEH.

3.2.2.5 Document leak/pressure testing of each piping system on "Leak/Pressure Test Certification" Form KEH-1757, sample appended. Forms will be furnished by KEH. Use 1 or more forms to describe and record each of the piping systems. Under "Description" describe each piping system in enough detail to be readily correlated to Contract Drawings. For systems tested segmentally, indicate continuity in "Description" to assure entire system has been tested.

3.2.2.6 Complete testing before pipe insulation is applied to above ground lines and before backfilling is completed over lines to be buried or encased.

3.2.2.7 Install one temporary relief valve during leak testing of piping systems. Relief valve shall have discharge capacity of at least 125 percent of capacity of pressurizing device and be set to operate at not more than 110 percent of the test pressure. Tag each relief valve used to show serial number, calibration date, and pressure setting.

3.2.2.8 Slowly raise pressure in section of piping undergoing test to specified test pressure.

3.2.2.9 Examine piping, fittings, and joints during testing and check manual valves for proper operation. Leaks shall be repaired and leaking section of piping retested.

3.2.2.10 Duration of leak tests shall be at least 10 minutes with no leaks or drop in test pressure, and for such additional time as necessary to conduct examination for leakage.

3.2.2.11 Remove water from lines immediately after testing is completed.

3.2.3 Test cold sanitary water lines in accordance with the UPC.

3.2.4 Test soil and vent lines in accordance with the UPC.

### 3.3 DISINFECTING

3.3.1 Following flushing and hydrostatic testing, disinfect sanitary water lines in accordance with AWWA C651.

3.3.2 Remove equipment parts subject to damage by disinfecting solution before operation, and disinfect before reinstallation.

# **PIPE CODE P-1**

<b>Service:</b>	<b>Max. Operating Pressure:</b>	<b>Max. Operating Temperature:</b>	<b>Test Pressure:</b>
Sanitary Water (SW)	100 psig	70 F	150 psig
Potable Water (PCW)	100 psig	70 F	150 psig
Non-Potable Water (NPCW)	100 psig	70 F	150 psig

<b>Sizes</b>	1/2" through 2"	: : 2" underground :
<b>Pipe</b>	Copper tubing, ASTM B88, Type L, hard drawn	: : Copper tubing, ASTM B88, : Type L, annealed :
<b>Wall Thickness</b>	Type L	: : Type L :
<b>Fittings</b>	ANSI/ASME B16.22 wrought copper.	
<b>Unions</b>		
<b>Valves</b>		
Ball	Crane No. 9301 or Approved Substitute	
Gate	Crane No. 1700 or Approved Substitute	
Check	Crane No. 1707 or Approved Substitute	
<b>Cleaning</b>	Flush with water in accordance with this Section.	
<b>Test</b>	Hydrostatically test piping at a pressure one and one-half times the maximum operating pressure.	
<b>Disinfect</b>	Disinfect sanitary water lines in accordance with this Section.	

**PIPE CODE P-2**

<b>Service:</b>	<b>Max. Operating Pressure:</b>	<b>Max. Operating Temperature:</b>	<b>Test Pressure:</b>
Building Drain (BD)	Atmospheric	100 F	In accordance with UPC

<b>Size</b>	Underground: 2" to 4"
<b>Pipe</b>	Poly-flowlines, black UV double containment piping system, stabilized block co-polymer polypropylene, ASTM D-4101.
<b>Joints</b>	Butt welded per ASTM D-2657 for polyolefin piping and in accordance with manufacturer's recommendations.
<b>Fittings</b>	Same as piping.
<b>Flanges</b>	Same as piping with dual-o-rings seals, stainless steel bolts, nuts and washers.
<b>Cleaning</b>	Flush with water in accordance with this Section.
<b>Test</b>	Inner and outer pipes tested in accordance with UPC Section 318, Paragraph 2, Water Test.

Project No 8-68011- C1		APPROVAL DATA LIST												
Project Title PFP Liquid Waste Treatment Facility		("X" Indicates Required Data)												
Specification Section 15400														
1  EPN IDENTIFICATION	2  DESCRIPTION	3  REFERENCE DRAWING	4  SPECIFICATION PARAGRAPH	5  DATA									6  REMARK	
				Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Installation Instructions		
BP 1	Backflow Preventor	II-2-82730		X		X					X			
PRV 6	Press. Regulating Valve	II-2-82730		X		X					X			
PRV 1	Press. Regulating Valve	II-2-82730		X		X					X			
PRV 2	Press. Regulating Valve	II-2-82730		X		X					X			
PRV 3	Press. Regulating Valve	II-2-82730		X		X					X			
ES	Emergency Shower and	II-2-82730												
	Eye Wash	II-2-82730		X		X						X		
FD	Floor Drain	II-2-82730		X		X								
FD 1	Floor Drain	II-2-82730		X		X								
BD	Building Drain		Pipe Code P2	X		X						X		
FCO	Floor Cleanout	II-2-82730		X		X						X		
PRV4	Press Regulatory Valve	II-2-82730		X		X					X			
AF1	Air Filter	II-2-82730		X		X		X			X			
FG1	Press Gauge	II-2-82730		X		X					X			
FC	Floor Cover	II-2-82730		X		X					X			
RV1	Press Relief Valve	II-2-82730		X		X					X			
RV2	Press Relief Valve	II-2-82730		X		X					X			
DP	Automatic DMP	II-2-82730		X		X						X		
PRV 5	Press Regulating Valve	II-2-82730		X		X					X			
RV 3	Press Relief Valve	II-2-82730		X		X					X			
RV 4	Press Relief Valve	II-2-82730		X		X					X			

[illegible]

**KAISER ENGINEERS  
HANFORD**

**LEAK/PRESSURE TEST CERTIFICATION**

Report No.

Page 1 of 2

Project or W.O. No.

Title

Design Reference

Test Procedure

Construction Spec. Ref.

Code or Standard

Year

Article

Class

Stamp Required

☐ Yes ☐ No

Description of System or Component(s) Test Boundary

**TEST PREPARATION**

Notification Requirements

☐ Quality Control

☐ Acceptance Inspection

☐ Safety Engineer

☐ Chief \_\_\_\_\_

☐ Authorized Inspector

☐ \_\_\_\_\_

Valve Line-up Requirements (for permanent valve only)

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Valve I.D. \_\_\_\_\_

☐ Open

☐ Close

Required Test Medium

Medium \_\_\_\_\_

Required Test Medium Temp

Temp \_\_\_\_\_

Flushing Requirements

Flushing \_\_\_\_\_

☐ Blue Chalking Required

☐ Soap Solution Required

Design System

Pressure \_\_\_\_\_

Design Test

Pressure \_\_\_\_\_

Specified

Hold Time \_\_\_\_\_

Prepared By

Date

**PRETEST CHECKLIST**

Item or Requirement

Craft  
Supervision

Quality Control

Accept

Date

Valve line-up per design requirements (see above line up).

Flushing of system and/or component completed per design requirements.

All lines or components not to be tested are properly isolated or disconnected.

Valves and openings checked; proper Pressure Relief Valve installed and discharge checked.

Test medium per design requirements; test pressure equalized.

Medium \_\_\_\_\_ Medium Temp. \_\_\_\_\_ (ASME only)

Test gauge(s) correct range and currently calibrated.

Size \_\_\_\_\_ Range \_\_\_\_\_ Cal. Due Date \_\_\_\_\_

Size \_\_\_\_\_ Range \_\_\_\_\_ Cal. Due Date \_\_\_\_\_

Size \_\_\_\_\_ Range \_\_\_\_\_ Cal. Due Date \_\_\_\_\_

Pressure Relief Valve properly set and currently calibrated.

Size \_\_\_\_\_ PSI Set \_\_\_\_\_ Checked Date \_\_\_\_\_

Size \_\_\_\_\_ PSI Set \_\_\_\_\_ Checked Date \_\_\_\_\_

Size \_\_\_\_\_ PSI Set \_\_\_\_\_ Checked Date \_\_\_\_\_

KEH-175781 (2/88)



# Form of Request

Quality Control  
Accept Date

ADT and other if applicable

50% Tip obtained and examination conducted  
Pressure examination at 0.10 Tip:

• Tip \_\_\_\_\_  
• Tip \_\_\_\_\_  
• Tip \_\_\_\_\_  
• Tip \_\_\_\_\_  
• Tip \_\_\_\_\_

Hydraulic testing - areas to be inspected shall be prior to application of pressure

Hydraulic testing - examination conducted while hydraulic pressure applied

Specified Tip \_\_\_\_\_ Pressure Tip \_\_\_\_\_

Pressure Test - deep section applied to areas to be tested and will be conducted while pressure is applied. Specified Tip \_\_\_\_\_

Pressure Test ☐ Accepted ☐ Rejected

Quality Control Signature

Stamp or PS No.

Date

## INSPECTION VERIFICATION

Documentation properly prepared.

☐ Yes ☐ No

All joints and welds are examined to pressure (returning) with joints shall be supported as specified.

☐ Yes ☐ No

All joints and welds are examined to pressure (returning) with joints shall be supported as specified.

☐ Yes ☐ No

Pressure Test

☐ Accepted ☐ Rejected

Acceptance Inspection Signature

Stamp or PS No.

Date

## OTHER

Comments

WCR No. (if applicable)

Client Representative

Date

Witness - ASME Authorized Inspector

Date

☐ Document Reviewed

☐ Drawings highlighted

Construction Engineering

PS No.

Date

15400-H03

REM-1737 22 (2/00)

15400.H03

END OF SECTION

B-680 H-C1

4/92

15400 - 13=

15

**SECTION 15493**  
**FLUID WASTE PIPING SYSTEMS**

**PART 1 - GENERAL**

**1.1 REFERENCES**

**1.1.1 Referenced Standards and Specifications:** The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

**1.1.1.1 American Society of Mechanical Engineers (ASME)**

<b>ASME</b>	<b>B16.3-1985</b>	<b>Malleable Iron Threaded Fittings, Classes 150 and 300</b>
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<b>ASME</b>	<b>A13.1-1981 (R 1985)</b>	<b>Scheme for the Identification of Piping Systems</b>
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**1.1.1.2 American Society of Mechanical Engineers (ASME)**

<b>1989 Edition w/Addenda through Dec 1990</b>	<b>Boiler and Pressure Vessel Code</b>
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<b>Section II</b>	<b>Material Specifications</b>
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<b>Section V</b>	<b>Nondestructive Examination</b>
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<b>Section IX</b>	<b>Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators</b>
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<b>ASME B31.3 - 1990 w/Errata</b>	<b>Chemical Plant and Petroleum Refinery Piping</b>
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**1.1.1.3 American Society for Testing and Materials (ASTM)**

<b>A 53-90a</b>	<b>Standard Specification for Pipe, Steel, Black and A 106 and Seamless</b>
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**Hot-Dipped, Zinc-Coated Welded**

	C 449-90a	Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
	D 1784-90	Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
	D 1785-89	Polyvinyl Chloride (PVC) Plastic Pipe Schedules 40, 80, and 120
	D 2464-90	Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
	D 2467	Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
	D 2837-90	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
	D 4101-82 (1988)	Propylene Plastic Injection and Extrusion Materials
1.1.1.4	American Welding Society (AWS)	
	D1.1-90	Structural Welding Code-Steel
	D1.3-89	Structural Welding Code-Sheet Steel
	QC1-88	Standard for AWS Certification of Welding Inspectors
1.1.1.5	American Water Works Association (AWWA)	
	C203-86	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines--Enamel and Tape--Hot-Applied

**1.1.1.6 Federal Specifications (FS)**

**HH-I-558B, 1971  
Including AMD 3, 1976**

**Insulation, Blocks, Boards,  
Blankets, Felts, Sleeving (Pipe  
And Tube Covering), And Pipe  
Fitting Covering, Thermal  
(Mineral Fiber, Industrial  
Type)**

**TT-S-00230C, 1970  
Including AMD 2, 1970**

**Sealing Compound: Elastomeric  
Type, Single Component (For  
Caulking, Sealing, And Glazing  
In Buildings And Other  
Structures)**

**1.1.1.7 International Conference of Building Officials (ICBO)**

**1988 Edition**

**Uniform Building Code (UBC)**

**1.1.1.8 Steel Structures Painting Council (SSPC)**

**SSPC-SP 3-89**

**No. 3 Power Tool Cleaning**

**SSPC-SP 6-89**

**No. 6 Commercial Blast Cleaning**

**1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.**

**1.2.1 Approval Data: Submit information listed in Column 5 of Approval  
Data List in this Section.**

**1.2.2 Vendor Information (VI): Submit Information listed in Column 5 of  
Vendor Information List in This Section.**

**1.3 QUALITY ASSURANCE**

**1.3.1 Qualification of Welding Personnel and Procedures**

**1.3.1.1 Personnel and procedures for welding (bonding) pressure retaining  
components along with attachments thereto, and pipe supports, shall have been  
qualified in accordance with ASME B31.3, paragraph 328.2 (A 328.2) before  
welding (bonding).**

**1.3.2 Qualification of Nondestructive Examination (NDE) Personnel**

**1.3.2.1 Visual weld (bonding) examinations and appropriate documentation  
shall be performed by Certified Welding Inspectors (CWI) who have received  
certification in accordance with AWS QC-1. Certified Associate Welding  
Inspectors (CAWI), certified in accordance with above standard, may perform  
examinations when under immediate direction of CWI.**

1.3.2.2 Welding (bonding) related examination documentation shall be signed, or stamped by individual performing examination. Where CAWIs are used for examinations, documentation shall be signed or stamped by both CAWI and CWI under whom examinations were performed.

1.3.3 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to KEH Field Contract Engineer in accordance with Section 01720.

<u>Document</u>	<u>Paragraph</u>
Welding Qualifications	1.3.1
NDE Qualifications	1.3.2
Welding Examination Documentation	3.2.1
Leak/Pressure Test Certification	3.2.2

#### 1.4 DELIVERY, STORAGE, AND HANDLING

##### 1.4.1 Pipe

1.4.1.1 Preserve identity of pipe and tube from time of receipt on site until installation is complete. While in storage, keep pipe and tube for each material specification confined to its own bundle or within dedicated space of confinement.

1.4.1.2 When pipe or tube is removed from bundle and cut, return remaining piece to bundle or clearly and permanently mark. Do not remove manufacturer's identifying tags from bundles.

1.4.1.3 When material identifying mark is cut from length of pipe or tube, re-mark remaining section clearly and permanently. Use either original marking or field code identification symbol.

##### 1.5 FURNISHED EQUIPMENT

Not used.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

2.1.1 Piping: Meet the requirements of attached pipe codes, and details on the Drawings.

2.1.1.1 Close or Butt Nipples not permitted.

2.1.1.2 Valves: Specified in pipe codes unless shown otherwise on the Drawings. Brand names and catalog numbers shown only to illustrate type and class of valve required. Unless otherwise specified, valve packing shall be manufacturer's standard for intended service.

2.1.1.3 Sealants for threaded piping joints: Teflon type tape, Scotch brand pipe No. 547, Chemtrol Dri-Seal No. 5 or Crane Packing Co. "Thread Tape".

2.1.2 Painting: See Section 09900.

2.1.3 Nonshrink Grout: See Section 03300.

2.1.4 Elastomeric Sealant for Pipe Penetrations: Light-colored polysulfide-base compound meeting the requirements of FS TT-S-00230, Type II, Class B.

2.1.5 Thermal Insulation

2.1.5.1 Outdoor applications

a. Molded, sectional, fiberglass pipe covering meeting the requirements of FS HH-I-558B, Form D, Type III, Class 12 for temperatures up to 450 F, and Class 13 for temperatures up to 650 F; complete with factory applied metal jacketing.

b. Metal jacket: Locking type waterproof longitudinal seam and circumferential seam closure straps with sealing compound to provide weather-proof joint. Metal jacket shall be minimum 0.016 inch thick aluminum (0.010 inch thick stainless steel) sheet.

2.1.5.2 Insulating cement for forming insulation covering over fittings and valves: Mineral-fiber cement meeting the requirements of ASTM C 449. Cements that contain asbestos not acceptable.

### 2.1.5.3 Piping Insulation Schedule

Service & Pipe Code	Pipe Size	Temp	Insulation Par Ref	Insulation Thickness
M-10 Process Water (PW)	:up to	:	:	:
Single Containment	:1-1/4"	: 70 F	: 2.1.5.1a	: 1"
	:1-1/2"	:	:	: 1-1/2"
	:to 2"	:	:	:
	:2-1/2"	:	:	: 2"
	:and up	:	:	:

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Piping, General

3.1.1.1 Fabricate and install in accordance with ASME B31.3, the Drawings, and this Section.

3.1.1.2 Cut pipe and tubing with cutters designed specifically for task.

3.1.1.3 Ream pipe and tubing to nominal inside diameter after cutting. Remove burrs from threads before assembly.

3.1.1.4 Make joints in threaded piping systems with joint sealant specified. Apply sealant to male threads only.

3.1.1.5 Keep piping systems clean. Once fabrication has started plug or cap ends of piping when installation is not in progress to prevent entry of dirt and other foreign material. Cap ends if work is not to be performed on pipe or spool within 4 hours, or, if due to environmental conditions, debris or water can enter pipe. Leave ends of spare lines capped or blind flanged when installation has been completed.

#### 3.1.2 Underground Piping

3.1.2.1 Place piping supports on undisturbed soil, or backfill placed and compacted in accordance with Section 02200, subparagraph 3.2.1.2.

3.1.2.2 Survey piping systems for elevation and location before final tie-in welds (bonds) to valve pits, risers, or fixed items. Complete placement of supports and meet Specification and Drawing requirements before survey. Elevation and location shall be in accordance with the Drawings. After final tie-ins, survey piping system again for final acceptance.

#### 3.1.3 Welding (Bonding)

3.1.3.1 Weld (Bond) piping, attachments to pressure retaining components, and pipe supports in accordance with ASME B31.3.

3.1.3.2 Protect outdoor welding (bonding) operation from rain and wind by using barriers to protect welder (bonder) and weld (bond) joint.

3.1.3.3 Complete piping welds (bonds) before tie-in welds (bonds) to valve pits, risers, or fixed items.

3.1.4 Cleaning

3.1.4.1 Water flushing

a. Obtain written approval of method for disposal of flushing water from KEH Acceptance Inspector.

b. Remove strainer screens before flushing, except those protecting control equipment. Clean screens protecting control equipment before flushing, if necessary, and after flushing is complete.

c. Flush piping with water until effluent is clean and contains no visible particulate matter. Duration of flush shall be at least one minute. Flushing pressure shall not exceed maximum operating pressure specified in pipe codes. Flushing water supply shall have sufficient capacity to produce flow velocity of at least 5 feet per second in largest pipe size, with full pipe. Provide flow measurement in flushing water supply line to be used as basis for verification of flow velocities in piping system by KEH.

d. When leak/pressure testing will not be performed immediately after flushing, dry following piping systems by blowing dry oil-free air or nitrogen through lines for at least 15 minutes. Use drain taps at low points of piping systems to ensure complete drainage and drying. Cap lines or reconnect to system to maintain cleanliness. Piping systems to be dried are as follows.

Service	Pipe Code
Compressed Air (CA)	M-2
Compressed Air Low Pressure (CAL)	M-10

3.1.5 Exterior Protective Coating

3.1.5.1 Complete leak testing before application of exterior protective coating.



**3.1.5.2** Protect short lengths of carbon steel pipe and fittings exposed to earth backfill with specified coating.

a. Clean carbon steel surfaces to white metal by sandblasting in accordance with SSPC-SP 6. Where blasting is impracticable, as determined by KEH, clean by power wire brushing in accordance with SSPC-SP 3.

b. Heat and apply specified tape in accordance with AWWA C203, Section 3, and manufacturer's instructions.

**3.1.5.3** After installation, examine carbon steel pipe having factory applied exterior protective coating, and joints, fittings, and short lengths of pipe having field applied exterior protective coating materials.

a. Use electrical holiday detector in accordance with AWWA C203, Section 2.14.12.

b. Repair damage to coating in accordance with AWWA C203, Section 2.15.

### **3.1.6 Piping Insulation**

#### **3.1.6.1 Pre-formed**

a. Apply after leak testing of line has been completed and after heat tape has been installed. Apply to pipe surfaces free of water, oil, dirt, loose scale, or other foreign material.

b. Abut sections and fill broken corners with insulating cement.

c. Install outdoor metal jacketed insulation in accordance with manufacturer's recommendations. Position longitudinal joints to shed water. Cover circumferential joints with sealing compound and sealing straps secured in place with 3/8 inch minimum width aluminum or stainless steel bands. Bands shall also be applied at mid point of 3 foot insulation sections.

d. Insulate valves and fittings in pipe lines smaller than 4 inches with insulating cement. Apply cement in 2 or more layers, according to total thickness specified. Each layer shall be no thicker than 1/2 inch and be allowed to dry before next application. Final 1/2 inch thick layer shall consist of 2 parts insulating cement and one part portland cement.

e. Mitered sections of straight jacketed pipe insulation may be used for fittings and elbows as alternate to subparagraphs 3.1.6.1d. Cement mitered aluminum jacketed insulation joints with weatherproof seal and install mitered bands. Cement nonmetallic jacketed insulation joints with weatherproof seal and apply seal strips with lap adhesive.

f. Insulate flanges with sectional and (or) block insulation of same material used on pipe. Terminate insulation on pipe adjacent to flanges with bevel far enough from flange to permit removal of flange bolts. Insulate flange to thickness 1/2 inch less than adjacent pipe covering to allow for 1/2 inch cement finish. Flange insulation shall extend 2 inches over ends of pipe insulation. Wire flange insulation in place and cover with 1/2 inch minimum thick layer of insulating cement.

g. Wrapunjacketed insulation, for outdoor applications, applied to flanges, fittings and valves with glass fabric over wet coat of weatherproof sealant lapping joints at least 2 inches. Apply second coat of weatherproof sealant, 1/8 inch wet thickness, after first coat has dried.

h. Seal penetrations of jacket for hanger rods for outdoor applications with weatherproof sealant.

3.1.7 Piping Identification: Identify exposed piping systems as to fluid carried and direction of flow in accordance with ANSI A13.1 and Appendix A.

### 3.2 FIELD QUALITY CONTROL

3.2.1 Nondestructive Examination (NDE) of Welds (Bond).

3.2.1.1 Perform NDE for each pipe code listed on back of attached NDE/Weld Record Form KEH-0433.00. (See Page 23 attached)

3.2.1.2 Visual examination: Perform in accordance with ASME B31.3, Paragraph 344.2 (A344.2). (See page 24 attached)

3.2.1.3 Perform random examination of piping supports in accordance with ASME B31.3, Paragraph 344.2.

3.2.1.4 NDE documentation

a. Documents examination of pressure containment welds (bonds) to pressure containment components for piping systems on NDE/Weld Record Form KEH-0433.00, sample appended.

1) See Form KEH-0433.00R for instructions for recording weld identification drawings, weld numbers, welder identification, welding procedure specification numbers, weld filler material, visual examinations, and for noting satisfactory completion of leak/pressure testing.

b. Required NDE shall be completed and documented before start of leak/pressure testing.

c. Document examination of pipe supports by recording on sketches or NDE/Weld Record form.

### **3.2.2 Leak/Pressure Testing**

#### **3.2.2.1 General**

a. Perform leak/pressure testing of pipe in accordance with ASME B31.3 and this Section.

b. Document testing of each piping system on "Leak/Pressure Test Certification" Form KEH-1757, sample appended. Use one or more forms to describe and record each piping system. Under "Description" describe piping system in enough detail to be correlated to identification drawings, shop fabrication drawings, and Contract Drawings, as applicable. For systems tested segmentally, indicate continuity in "Description" to ensure entire system has been tested.

c. Pipe joints, fittings and other potential leak sources to be tested shall be visible and accessible during tests.

d. Complete testing of piping before field application of insulation or protective coating.

e. Install necessary restraining devices, before applying test pressure, to prevent distortion or displacement of piping.

f. Install one temporary relief valve during testing. Relief valve shall have discharge capacity of at least 125 percent of capacity of pressurizing device and be set to operate at not more than 110 percent of test pressure. Tag each relief valve used to show serial number, calibration date, and pressure setting.

g. Isolate instruments and other items which could be damaged by test pressures.

h. Visually examine piping and tubing joints, fittings, and other potential leak sources, includes welds which attach wear plates, anchors, etc. to piping systems, during testing. Repair leaks and re-examine.

i. Duration of tests, excluding sensitive leak test, shall be at least 10 minutes with no visible leaks or drop in test pressure, and for such additional time as may be necessary to conduct examination for leakage.

#### **3.2.2.2 Hydrostatic testing**

a. Obtain written approval of method for disposal of water used for testing from KEH Field Contract Engineer.

b. Perform as designated in applicable Pipe Codes.

c. Verify air has been expelled from piping before applying hydrostatic pressure.

d. Coat piping joints, fittings and other potential leak sources, includes welds attaching wear plates, anchors, etc, to piping systems, with mixture of powdered blue chalk and water, and allow to dry before filling piping with water and inspecting for leaks.

e. Remove water from lines immediately after hydrostatic testing is completed. After final tie-ins, KEH Field Contract Engineer will survey piping system for final acceptance.

f. Dry piping systems by blowing dry oil-free air or nitrogen through lines for period of at least 15 minutes. Provide 1/2 inch IPS drain taps at low points of piping systems to ensure complete drainage and drying. Piping systems to be dried are as follows:

Service	Pipe Code
Compressed Air	M-2
Compressed Air (CAL)	M-10

#### 3.2.2.3 Pipe Code M - 3 Testing

a. Each joint of the inner piping shall be visually examined for leaks during the pressure test with the KEH Acceptance Inspector present before the outer containment pipe is joined together. Each joint of the outer containment pipe shall be visually examined for leaks during the pressure test with the KEH Field Contract Engineer present.

b. The test should be done in gradual steps of 10 psig until the desired pressure is achieved. After one hour, check the pressure gauge. If there is a decrease, without an indication of leakage, pump the pressure back up to test pressure. If the total pressure drops more than 10% after this second pressurization, then the test can be considered as a failed test and the system checked for leaks or problems. Otherwise, continue the pressure test for a minimum of two hours.

c. Cyclic Hydrostatic Testing: After the total length of Pipe Code M - 3 Piping is installed, provide seven cycles as recommended by pipe manufacturer.

d. Manufacturer representative shall certify installers and be present for a minimum of two days construction. Manufacturer provide in writing certifying that the piping installation is in accordance with manufacturer's recommendations.

# PIPE CODE M-2

Service:  
Compressed Air (CAH)

Max Operating Pressure:  
125 psig

Max Operating Temp:  
100 F

Sizes	: 1" and Smaller
Pipe	: Black steel, ASTM A 106, Grade A or B
Wall Thickness	: Schedule 40
Nipples	: Schedule 40, close or butt not permitted.
Fittings	: Class 300 malleable iron, threaded in accordance with ASME B16.3.
Unions	: 300# malleable iron, threaded, bronze to iron seat, Walworth No. 7227.
Flanges	: None
Valves	:
Gate	: Powell 3755 : Crane Co No. 424 : Walworth Co No. 37
Globe	: Crane Co No. 212P : Walworth Co No. 245-P : Powell 2608A
Angle	: Crane Co No. 214P : Walworth Co No. 246P : Lunkenheimer Fig No. 72-PS
Check	: Crane Co No. 36 : Walworth Fig No. 420

# PIPE CODE M-3

Service:	Max Operating Pressure:	Max Operating Temp:
A. 10" Encasement Pipe (EP) with	Atmospheric	100
(1) 2" Process Water	70 psig	100
(2) 3" Process Water Drain	Atmospheric	100
(3) 3" Process Building Drain	Atmospheric	100

Sizes	: 1/2" to 3"	: 10" Diameter Encasement Pipe
Pipe	: ASAHI/American Duo-Pro 150 double containment piping system, : proline co-polymer polypropylene, Type II, ASTM D 4101-86, : ASTM D2837.	
Wall Thickness & Fittings	: SDR 11 - Fittings shall be factory: : fabricated.	: SDR 11- Fitting shall be factory : fabricated and include restrictors : and enlarge elbow for expansion : and contraction.
Joints	: Straggard thermal buttfusion for : all Butt fusion for Piping.	
Flanges	: Same as pipe with stainless steel bolts and nuts.	
Bolting	: Coordinate with Pipe Code M-10 bolt patterns.	
Gaskets	: ASAHI/American AV gaskets, teflon-bonded EPDM.	
Cleaning	: Flush with water in accordance with this Section.	
Test	: Test pressure shall be 1-1/2 times: : the maximum operating pressure :318, Para. 2, water test.	
O-Rings	: Double "O" ring sent typical for each pipe penetration for encasement : piping. O-rings shall be rated for 150 psig pressure.	

**PIPE CODE M-10**

<b>Service:</b>	<b>Max Operating Pressure:</b>	<b>Max Operating Temp:</b>
Process Water (PW)	70	100
Overflow (OVFL)	Atmospheric	100
Non-Potable Water (NPW)	70	100
Single Containment Building Drain(SBD)	Atmospheric	100
Building Vent (V)	Atmospheric	100
Process Drain (PD)	70	100
Compressed Air Low Pressure (CAL)	15	100
Non-Potable Cold Water (NPCW)	15	100

# PIPE CODE M-10 (continued)

Sizes	: 1/2" to 6"
Pipe	: Polyvinyl chloride (PVC), ASTM D 1784-65T, PVC Type 1 material and ASTM D 1785 for Sch. 40 and 80.
Wall Thickness	: Schedule 80
Nipples	: None
Fittings	: PVC Type 1, Grade 1 (Cell Classification 1245B), ASTM D-1784. : Dimension meet requirements of ASTM D 2464 (threaded Schedule 80 fittings) and D-2467 (socket Schedule 80 PVC fittings).
Unions	: Same as fittings.
Flanges	: Same as fittings with stainless steel bolts, nuts and washers.
Bolting	: Zinc plated bolts, nuts and washers for 150 lb flanges.
Gaskets	: Neoprene full-face gasket.
Flexible Connection	: Metra-Flex constructed of all 316 stainless steel, ends, single braided corrugated hose. Size and ends shall be as shown on drawings. Provide six spare 1" flexible connections for the canisters in the Plant Area and six spare 1" flexible connections for the canisters in the Drum Washing Area. Locate spares in Drum Washing Area.
Quick Disconnect	: Quick-disconnect coupler and adapter with all 316 stainless steel body, Viton-A gasket and 1" NPT ends. Ryan Herco Model 1315-010 male adapter and Model 1318-010 male coupler. Provide six spare adapters and coupler and locate on rack in Drum Washing Area.



# **PIPE CODE M-10 (continued)**

<b>Valves</b>	:
	:
<b>Ball</b>	:Harrington True Union ball valves, PVC (140 deg. F.): 1/2"
	:BV10050S, socket, 3" BV10300F, flanged, viton, 4" BV10400F,
	:flanged.
	:
<b>Ball</b>	:PBM, Inc. 2-way ball valves - 31655: 1" SPH-14-F152,
	:1-1/2" SPH-16-F152, 2" SPH-17-F152. Flanged ends
	:
<b>Check</b>	:Check valves located in the vertical line shall be Harrington Model 1011, PCV
	:Spring Check Valve with socket weld ends, stainless steel trim, and Buna-N-
	:Seal.
	:
<b>Check</b>	:Check valves located in the horizontal line shall be Harrington Model 1520-
	:PVC Spring Check Valve with socket weld ends and Buna-N-Seal.
	:
<b>Control</b>	:Worcester Controls 316 SS Series 94 with 150 psig flanges: (See
	:Section 13440 for actuator and valve positioner.) "N" CPT-9466-PT150
	:w/60°V port; mounted 328/S. Control valve and actuator shall be mated at
	:the factory. See Section 13440 for specification of actuator.
	: "N" shall be 1" for FCV-1 and FCV-2; N shall be 1 1/2" for LCV-1 and
	:LCV-2.
	:
<b>Diverter</b>	:PBM, Inc. 3-way diverter ball valves: 316 SS, Angle Port Style
	:No. 15.
	:3 Way Motor PBM Inc, 316 SS, model MPH-19-F152/POCIHG, 3" size, 3 way multi-
	:port, 150 lb flanges, angle port valve ball, preparation for actuation.
	:Motor valve and actuator shall be mated at the factory. See section 13440
	:for specification of actuator.
	:
<b>Motor</b>	:Worcester Controls 316 SS Series 94 with 150 psig flanges: 1-1/2" 9466 T150
	:with mounting kit MK 332. Motor valve and actuator shall be mated at the
	:factory. See Section 13440 for specification of actuator.
	:
<b>Pressure Relief</b>	:PSV1, PSV2, Keckley model 42, with bronze body, and stainless steel trim, 2"
	:size for process water service with 10 psig operating pressure and 15 psig
	:relief pressure setting.
	:
<b>Test Maximum</b>	:Hydraulically test all piping at a pressure one and one half (1 1/2) times the
	:operating pressure. Atmospheric shall be tested in accordance with UPC
	:Section 318, Paragraph 2, Water Test.
	:

# PIPE CODE M-11

Service:	Max Operating Pressure:	Max Operating Temp:
A. 8" Encasement Pipe (EP) with	Atmospheric	100
(1) 6" Effluent from Manhole 5	Atmospheric	100

Sizes	: 6"	: 8" Diameter Encasement Pipe
Pipe	: ASAHI/American Duo-Pro 150 double containment piping system, : proline co-polymer polypropylene, Type II, ASTM D 4101-86, : ASTM D2837.	
Wall Thickness & Fittings	: SDR 11 - Fittings shall be factory: : fabricated.	: SDR 11- Fitting shall be factory : fabricated and include restrictors : and enlarge elbow for expansion : and contraction.
Joints	: Staggared thermal Butt Fusion for : all piping.	
Flanges	: Same as pipe with stainless steel bolts and nuts.	
Bolting	: Coordinate with Pipe Code M-10 bolt patterns.	
Gaskets	: ASAHI/American AV gaskets, teflon-bonded EPDM.	
Cleaning	: Flush with water in accordance with this Section.	
Test	: Test pressure shall be 1-1/2 times: : the maximum operating pressure	: Test in accordance with UPC Section : 318, Para. 2, water test.
O-Rings	: Double "O" ring sent typical for each pipe penetration for encasement : piping. O-rings shall be rated for 150 psig pressure.	

# PIPE CODE M-12

Service: Max Operating Pressure: Max Operating Temp:

Process Water (PD) 70 100

Sizes	: 3" to 4"
Pipe	: Polyvinyl chloride (PVC), ASTM D 1784-65T, PVC Type 1 material and ASTM D 1785 for Sch. 40 and 80.
Wall Thickness	: Schedule 40
Nipples	: None
Fittings	: PVC Type 1, Grade 1 (Cell Classification 1245B), ASTM D-1784. : Dimension meet requirements of ASTM D 2464 (threaded Schedule 40 fittings) and D-2467 (socket Schedule 40 PVC fittings).
Unions	: Same as fittings.
Flanges	: Same as fittings with stainless steel bolts, nuts and washers.
Bolting	: Zinc plated bolts, nuts and washers for 150 lb flanges.
Gaskets	: Neoprene full-face gasket.
Flexible Connection	: Metra-Flex constructed of all 316 stainless steel, ends, single braided corrugated hose. Size and ends shall be as shown on drawings. Provide six spare 1" flexible connections for the canisters in the Plant Area and six spare 1" flexible connections for the canisters in the Drum Washing Area. Locate spares in Drum Washing Area.
Cleaning	: Flush with water in accordance with this Section
O-Rings	: Double "O" rings sent typical for each pipe penetration for piping. : O-Rings shall be rated for 150 psig pressure.
Test Maximum	: Hydraulically test all piping at a pressure one and one half (1 1/2) times the operating pressure. Atmospheric shall be tested in accordance with UPC Section 318, Paragraph 2, Water Test.

## **APPENDIX A - IDENTIFICATION OF PIPING SYSTEMS**

### **1. GENERAL**

The identification of piping systems shall be in accordance with the American Standard Scheme for the Identification of Piping Systems, ANSI A13.1, as supplemented herein.

### **2. LOCATION**

- a. Except as provided below, identification shall be located adjacent to outlets, valves, flanges, unions, changes-in-direction, where pipes pass through walls, floors, or ceilings, and along an uninterrupted length branch in a room shall have at least one identification.
- b. Where a number of outlets, valves, flanges, unions, or changes of direction make identification at each item impracticable, they may be spaced at approximate 6 foot intervals, preferably adjacent to valves.
- c. Legend shall be located on the pipe so that it can be read easily from the operator's normal viewing position. Labels shall be placed on the readily visible lower quadrant of overhead pipes, and on an upper quadrant pipes below normal eye level. Above ceilings, labels shall be placed in locations most readily visible from access positions.

### **3. LEGEND**

- a. Positive identification of a piping system content shall be by lettered legend giving the name of the content in full or abbreviated form. Legends may also be as specified on drawings or in other specifications.
- b. Abbreviation of words in the legend may be used only where unavoidable due to space limitations.
- c. The legend shall include the nominal operating pressure for steam, compressed air, and when specified, the pressure or temperature for other materials.
- d. An arrow indicating the direction of flow shall be placed near the legend on pipes normally having a flow in one direction only. The color and size of the arrow shall be consistent with the color and size of the legend letters.
- e. Legend shall be located on or adjacent to the classification color band.

4. APPROVED LABELS

- a. Legend and color classification may be accomplished by the use of approved labels conforming to this Standard and which are suitable for the temperature of the surface to which they are to be applied. Approved labels include the following.

**ALL-TEMPERATURE PIPE MARKERS**

W. H. Brady Company  
727 West Glendale Avenue  
Milwaukee, Wisconsin 53201

**TEL-A-PIPES**

Westline Products Division  
Thomas & Betts Company  
220 South Rose Street  
Los Angeles, California 90012

- b. Single-word labels may be combined to form complete legends. Individual-letter labels shall not be so combined.
- c. Labels shall be installed after painting is complete.

5. CLASSIFICATION COLOR

- a. When use of classification colors is specified, they shall conform to Table 1.

TABLE 1			
Classification	Band or Label Color	Legend/Arrow Color	Approximate Color No. Per Federal Std. No. 595
Fire Protection	Red	White (17875)	11105 (red)
Dangerous	Yellow	Black (17038)	13655 (yellow)
Safe	Green	Black (17038)	14260 (green)
Life Support	Blue	White (17875)	15102 (blue)

- b. Paint, if used, shall conform to Federal Specification TT-E-489, Class A, for synthetic gloss enamel.
- c. Classification colors shall conform to Table 2.

TABLE 2 CLASSIFICATION COLORS	
Material	Color
Steam	Yellow
Sanitary Water (SW)	Green
Process Sodium Hydroxide (NaOH)	Yellow
Raw Water (RW)	Green

END OF APPENDIX

Specification Section 15496

**("X" Indicates Required Data)**

[illegible]

[illegible]



Project or W O No		Test		Design Reference		Test Procedure	
Construction Spec Ref	Code or Standard	Year	Access	Class	Stamp Required <input type="checkbox"/> Yes <input type="checkbox"/> No		
Description of System or Component(s) Test Boundary							

### TEST PREPARATION

Notification Requirements	Valve Line-Up Requirements (for permanent valves installed)																		
<input type="checkbox"/> Quality Control <input type="checkbox"/> Acceptance Inspection <input type="checkbox"/> Safety Engineer <input type="checkbox"/> Client _____ <input type="checkbox"/> Authorized Inspector _____ <input type="checkbox"/> _____	<table style="width:100%;"> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve ID _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> </table>	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	
Valve ID _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close																	

Required Test Medium _____ Medium _____	Required Test Medium Temp. _____ Temp _____	Pushing Requirements <input type="checkbox"/> Blue Chilling Required <input type="checkbox"/> Soap Solution Required
Design System _____ Pressure _____	Design Test _____ Pressure _____	Specified _____ Hold Time _____
		Prepared by _____ Date _____

### PRETEST CHECKLIST

Item or Requirement	C/N	Quality Control	
	Supervision	Accept	Date
Valve line-up per design requirements (see above line up)			
Pushing of system and/or component completed per design requirements.			
All lines or components not to be tested are properly isolated or disconnected			
Valves and openings checked. Proper Pressure Relief Valve installed and discharge checked			
Test medium per design requirements; temperature equalized.			
Medium _____ Medium Temp. _____ (ASME only)			
Test gauges (if correct range and currently calibrated).			
PSI _____ Range _____ Cal. Due Date _____ PSI _____ Range _____ Cal. Due Date _____ PSI _____ Range _____ Cal. Due Date _____ PSI _____ Range _____ Cal. Due Date _____ Pressure Relief Valve properly set and currently calibrated.			
PSI Set _____ Checked Date _____ PSI Set _____ Checked Date _____ PSI Set _____ Checked Date _____ PSI Set _____ Checked Date _____			

## TEST PERFORMANCE

Item or Requirement	Quality Control
	Accept
RTIME and other if specified.	
50% Tp obtained and examination conducted • Tp _____	
Pressure increments at 0.10 Tp • Tp _____	
• Tp _____	
• Tp _____	
• Tp _____	
• Tp _____	
• Tp _____	

Hydrostatic testing - areas to be inspected chalked prior to application of pressure

Hydrostatic testing - examination conducted while system/component pressurized

Specified Tp \_\_\_\_\_ PSI obtained at \_\_\_\_\_ a.m. p.m.

Pneumatic Testing - soap solution applied to areas to be tested and system/components examined while pressurized.

Specified Tp \_\_\_\_\_ PSI obtained at \_\_\_\_\_ a.m. p.m.

Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Quality Control Signature _____	Stamp or PR No. _____	Date _____
--	---------------------------------	-----------------------	------------

## INSPECTION VERIFICATION

Documentation properly prepared	<input type="checkbox"/> Yes <input type="checkbox"/> No	Actual Tp during final inspection _____	
All joints and welded attachments to pressure retaining components chalked/soaped as applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No	Specified hold time verified at _____	
All joints and welded attachments to pressure retaining components visually inspected for leakage.	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Acceptance Inspection Signature _____	Stamp or PR No. _____	Date _____

## OTHER

Comments

MCR No. (if applicable) _____	Client Representative _____	Date _____
	Witness - ASME Authorized Inspector _____	Date _____
<input type="checkbox"/> Document Reviewed <input type="checkbox"/> Drawings Highlighted	Construction Engineering _____	PR No. _____    Date _____

WELD INFORMATION	VISUAL EXAMINATION			5. LIQUID PEN. MAG. PART.	7. RADIO. LEAK TEST	9. Other:
	Fit-up	Root Pass	Cover Pass			
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						

**INSTRUCTIONS FOR USE**

The NDE/WELD RECORD form shall be used to document the nondestructive examination/testing of the piping systems listed below. Entries shall be made as work progresses, and records are subject to review by the Government's Representative at any time.

Complete the NDE/WELD RECORD as follows (number in parenthesis corresponds to block number)

- (1) Enter Project Number.
- (2) Enter Weld Identification Drawing Numbers.
- (3) Enter name of Contractor.
- (4) Enter Weld Information:
  - Weld Number
  - Welder Identification
- Welding Procedure Specification
- Weld Filler Material (Type)
- (5) through (9) Enter date of examination testing in upper half of block; or stamp lower half of block as weld is examined and accepted in compliance with contract requirements

**NONDESTRUCTIVE EXAMINATION/TESTING REQUIREMENTS FOR PIPING SYSTEMS**

NOE/NOT METHOD	PIPE CODES	M2	M3	M10	M11					COMMENTS
<b>VISUAL</b>										
Fitup										
Root Pass										
Cover Pass			X (G)	X (G)	X (G)					
<b>LIQUID PENETRANT</b>										
Root Pass										
Cover Pass										
<b>MAGNETIC PARTICLE</b>										
Root Pass										
Cover Pass										
<b>RADIOGRAPHIC</b>										
Completed Weld										
<b>LEAK/PRESSURE</b>		X								
Completed Weld			X (G)	X (G)	X (G)					
<b>OTHER</b>										

**Legend**

- |   |  |
|---|--|
| <p>A. Requires witnessing concurrently by the Government Representative and acceptance prior to recording.</p> <p>B. Requires acceptance of radiographs and documentation by the Government Representative prior to recording.</p> <p>C. Circumferential and longitudinal butt welds.</p> <p>D. Full penetration welds on branch connections.</p> | <p>E. Attachment welds to pipe.</p> <p>F. Tie-in circumferential and longitudinal butt welds that cannot be examined by leak/pressure test.</p> <p>G. Other: Plastic pipe: Inspect for alignment before butt welding and pressure check.</p> |
|---|--|

## SECTION 15500

### HEATING, VENTILATING, AND AIR CONDITIONING

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

- 1.1.1.1 Air Movement and Control Association, Inc (AMCA)  
Publication 99-83, Standards Handbook  
Revised 1986
- 1.1.1.2 American National Standards Institute (ANSI)  
B16.22-1989 Wrought Copper and Copper Alloy  
Solder-Joint Pressure Fittings  
N13.1-69(R1982) Sampling Airborne Radioactive  
Materials in Nuclear Facilities
- 1.1.1.3 American Society of Heating, Refrigerating, and Air-Conditioning  
Engineers (ASHRAE)  
1988 Equipment Volume ASHRAE Handbook
- 1.1.1.4 American Society of Mechanical Engineers (ASME)  
1989 Edition, w/Addenda ASME Boiler and Pressure Vessel  
through Dec 1989 Code  
Section IX Qualification Standard for  
Welding and Brazing Procedures,  
Welders, Brazers, and Welding  
and Brazing Operators
- 1.1.1.5 American Society for Testing and Materials (ASTM)  
A 36-90 Structural Steel  
A 108-90a Steel Bars, Carbon,  
Cold-Finished, Standard Quality  
A 123-89a Zinc (Hot-Galvanized) Coatings  
on Iron and Steel Products  
A 240-90 Heat-Resisting Chromium and  
Chromium-Nickel Stainless  
Plate, Sheet and Strip for  
Pressure Vessels.

	A 276 90a	Stainless and Heat-Resisting Steel Bars and Shapes
	A 307-90	Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
	A 366-85	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
	A 527-90	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
	A 563-90	Carbon and Alloy Steel Nuts
	A 569-85	Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality
	A 570-90	Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
	B 88-89	Seamless Copper Water Tube
1.1.1.6	American Welding Society (AWS)	
	A5.8-89	Brazing Filler Material
	D1.1-90	Structural Welding Code - Steel
	D9.1-90	Welding of Sheet Metal
1.1.1.7	Code of Federal Regulations (CFR)	
	40 CFR 60, Appendix A	Testing methods for Ducts and Stacks
	40 CFR 75	Exhaust Duct and Stack Sampling and Flow Measurement
1.1.1.8	Federal Specifications (FS)	
	TT-S-00230C, 1970 Including AMD 2, 1970	Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, And Glazing In Buildings And Other Structures)
1.1.1.9	International Association of Plumbing and Mechanical Officials (IAPMO)	
	1988 Edition	Uniform Plumbing Code (UPC)

1.1.1.10 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc (MSS)

SP-58  
1983 Edition

Pipe Hangers and Supports -  
Materials, Design and  
Manufacture

1.1.1.11 National Electrical Manufacturers Association (NEMA)

MG 1-1987

Motors and Generators

1.1.1.12 National Fire Protection Association (NFPA)

NFPA 70

National Electrical Code,  
1990 Edition

1.1.1.13 Sheet Metal and Air Conditioning Contractors National Association, Inc (SMACNA)

1985, 1st Edition

HVAC Duct Construction  
Standards Metal and Flexible

1983, 1st Edition

HVAC Systems--Testing,  
Adjusting and Balancing

1.1.1.14 Underwriters Laboratories, Inc (UL)

1991, Including  
Supplements

Building Materials Directory

UL 181-1990

Factory-Made Air  
Ducts and Connectors

1.2 SUBMITTALS: Refer to section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed on Approval Data List in this Section.

1.2.2 Vendor Information (VI): Submit Information listed in Column 5 of Vendor Information List in this Section.

1.2.3 Fabricator Drawings: Submit dimensioned fabrication and installation drawings, complete with material lists of following items.

1.2.3.1 Exhaust hood along with hangers, supports and anchoring devices.

1.2.3.2 Control system diagram with information on controls. Select control ranges and components necessary to comply with sequence of operation shown on the drawings and described herein.

1.2.4 Test and Balance Data: Submit documentation of test and balance data, dated and signed by contractor executing test.

1.2.5 Control System Functional Verification Procedure: Submit procedure to verify control system performs in accordance with approved sequence of operation.

1.2.6 Control System Functional Verification Report: Submit documentation of control system operation. Report shall tabulate actions performed during test, system response to actions, and characteristics of system encountered during test. Sign and date report.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding structural steel, nonpressure components, shall have been qualified in accordance with AWS D1.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.2 Personnel and procedures for welding sheet metal shall have been qualified in accordance with AWS D9.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.3 Maintain file of welding procedure specifications, procedure qualification records and welder performance qualification test results at site for review.

#### 1.3.2 Qualification of Brazing Personnel and Procedures

1.3.2.1 Personnel and procedures for brazing shall have been qualified in accordance with ASME Section IX before brazing.

1.3.2.2 Maintain file of brazing procedures specifications, procedure qualification records, and brazer performance qualification test results at site for review.

### 1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Preserve identity of materials from time of receipt on site until use in facility construction.

1.4.2 Store separate materials meeting requirements of different material specifications.

1.4.3 Store and control filler material in accordance with approved procedure.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Duct

2.1.1.1 Galvanized steel sheet meeting the requirements of ASTM A 527, and/or A526 G90 coating.



- 2.1.1.2 Stainless steel sheet meeting the requirements of ASTM A 240, Type 304L.
- 2.1.2 Duct Reinforcement
  - 2.1.2.1 Carbon steel sheet meeting the requirements of ASTM A 366, A 569 or A 570.
  - 2.1.2.2 Carbon steel shapes meeting the requirements of ASTM A 36 galvanized in accordance with ASTM A 123.
  - 2.1.2.3 Stainless steel sheet meeting the requirements of ASTM A 240, Type 304 or 304L.
  - 2.1.2.4 Stainless steel shapes meeting the requirements of ASTM A 276, Type 304 or 304L.
- 2.1.3 Duct Supports and Hangers
  - 2.1.3.1 Unistrut channels and clamps.
  - 2.1.3.2 Carbon steel shapes meeting the requirements of ASTM A 36.
  - 2.1.3.3 Carbon steel rods meeting the requirements of ASTM A 108 with ASTM A 563 nuts and plain washers.
  - 2.1.3.4 Stainless steel shapes meeting the requirements of ASTM A 276, Type 304 or 304L.
- 2.1.4 Fasteners: ASTM A 307, Grade A or B bolts, with heavy hex nuts meeting the requirements of ASTM A 563, UNC threads. Finish to be cadmium plating or electro-galvanizing.
- 2.1.5 Rivets: Similar to Marsen "Klik-Fast" blind pop rivets.
- 2.1.6 Fabric: Similar to Ventfabrics Inc "Ventglas", 30 ounce per square yard, finished weight, glass cloth double-coated with neoprene.
- 2.1.7 Duct Accessories: Standard products of manufacturer may be acceptable, subject to approval of KEH Field Contract Engineer. Duct accessories shall be same material as duct.
  - 2.1.7.1 Turning vanes are required in rectangular section square elbows. Vanes shall be double thickness, tubular blades tapered to fine edge. Blades shall be assembled with, and equally spaced on, side runners for installation in elbows with bolts or rivets.
  - 2.1.7.2 Filters: See drawings.
  - 2.1.7.3 Duct sealer: Oil-resistant elastomer containing approximately 50 percent solids by weight in blended ketone solvent. Container labels shall show name of material, date of manufacture, shelf life, curing time, mixing and application instructions.

2.1.7.4 Zinc-rich coating: Similar to Crown 7001 metallic zinc paint.

2.1.7.5 Gaskets: Type 2C2 for closed cell rubber gaskets. Provide at all duct flange connections.

2.1.8 Duct Insulation: UL listed and carry UL mark.

2.1.8.1 Insulation and adhesive shall have UL fire hazard classification for flame spread of not more than 25 and for smoke developed of not more than 50.

2.1.8.2 Insulation: Uniform thickness for each duct size and piece of equipment.

2.1.8.3 Insulation for exterior surfaces of interior HVAC duct

a. Outside air duct in process plant area: 1 inch thick similar to Manville rigid 800 Series Spin-Glass Fiberglass, 6 pcf density, with AP facing.

b. Accessories (mechanical fasteners, cement, wrap, vapor barrier, tape) shall be as recommended by manufacturer.

2.1.9 Pipe and Fittings: Meet the requirements of Codes listed in this Section.

2.1.10 Pipe Hangers and Supports

2.1.10.1 Use box strapping, conduit clamps or pipe hangers for single lines.

2.1.10.2 Hangers and supports shall meet the requirements of MSS SP-58.

2.1.10.3 Pipe hangers: Similar to Grinnell Figure CT-109 split tubing rings with Figure CT-114 turnbuckle adjusters for rod suspension.

2.1.10.4 Pipe wall brackets: Similar to Grinnell Figure 9120 tube straps.

2.1.11 Pipe Joint Sealant: For threaded piping joints, similar to Crane Packing Company "JC-30".

2.1.12 Pipe Penetration Sealant: Elastomeric, light-colored polysulfide-base compound meeting the requirements of FS TT-S-00230C, Type II, Class B.

2.1.13 Equipment Nameplates: Laminated plastic, 1/16 inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature sharp and clear.

## 2.2 EQUIPMENT

### 2.2.1 General

2.2.1.1 Ratings and Sizes: Air moving equipment ratings and sizes are based on AMCA standard air at 70 F and 29.92 inches barometer, in accordance with AMCA Publication 99. Equipment ratings establish minimum requirements.

2.2.1.2 Painting: Prime and paint equipment in accordance with manufacturer's standard except paint containing lead will not be acceptable.

2.2.1.3 See drawings.

## 2.2.2 Electric Motors

2.2.2.1 Motors: Class B insulation, sealed permanently lubricated bearings and meet the requirements of NEMA MG 1.

2.2.2.2 Motors furnished with equipment: Sizes required for application but no smaller than sizes shown on the drawings.

a. Integral horsepower motors: Squirrel-cage, general purpose, induction, Design B, classified for continuous duty.

b. Motors for outdoor use: Totally enclosed.

2.2.3 Automatic Control Systems: As shown on the drawings. Electrical wiring required for interlocks and controls shall be shown on the drawings. Where additional relays are required or where single instrument performs function of 2 or more instruments shown on the drawings, such changes will be acceptable provided they do not conflict with intended sequence of operation. All wiring shall be in accordance with NFPA 70 and Section 16400.

2.2.3.1 Source of electrical control voltage shown on the drawings.

## 2.2.4 Instruments and Controls

2.2.4.1 Room thermostats (T): Furnished with unit heater shown on the drawings.

2.2.4.2 Duct thermostats (DT): Furnished with duct heater system shown on the drawings.

2.2.4.3 Automatic damper motor: See drawings.

2.2.4.4 Control relays (R): 120 volt coils and contacts arrangements (DPDT) suitable for application.

2.2.5 Flow Measuring Unit: Shown on the drawings and consisting of following.

2.2.5.1 Air treatment section capable of developing flow into flat velocity profile at specific measuring plane downstream of section and utilizing Type 304 stainless steel hexagonal cell.

2.2.5.2 Velocity pressure sensing section of Type 316 stainless steel consisting of series of total and static pressure sensors interconnected by network of tube heads.

2.2.5.3 Unit casing: Minimum 0.0516 inch galvanized steel, welded construction with zinc-rich paint touch-up. Connecting flanges each side 1-1/2 inch by 1-1/2 inch by 1/8 inch angle.

2.2.5.4 Similar to Air Monitor Corporation "Fan-E" flow monitoring and isokinetic sampling unit, 14 inches diameter.

## 2.2.6 Radiation Monitor Probe, Regulated Air Sampler

2.2.6.1 Radiation Monitor Probe: Multi-probe sample withdrawal section of Type 316 stainless steel for insertion in 14 inches diameter. Radiation monitoring probe section consisting of multi-probe sample withdrawal unit of Type 316 stainless steel, incorporated in velocity pressure sensing section. Design unit to withdraw isokinetic sample from exhaust airstream. Unit composed of array of 1 or more tube headers, each with series of withdrawal probes arranged to face directly into air stream and extract representative sample of particles present in exhaust airstream. Probes shall consist of sampling tubes terminating in tapered knife-edges at ports. Each port shall be at end of straight section of tube of length greater than or equal to 5 times port diameter. Bends shall have radius greater than or equal to 5 times port diameter. Design tube headers and sampling tubes for laminar flow. Interior surfaces shall be smooth. Unit removable from casing. Fabrication shall meet requirements of ANSI N13.1 40 CFR 60 Appendix A, and 40 CFR 75.

2.2.6.2 Regulated Air Sampler RAS1 (Government Furnished): Portable air particulate sampler shall have an oil-free carbon vane vacuum pump, motor airflow regulatory flowmeter, vacuum gauge and filter holder. Unit shall provide a constant pressure drop across an in-line adjustable orifice from 0 up to maximum flow capacity of pump. Unit shall have 1/4 HP motor with 115 volts and 60 HZ electrical requirements; 26" HG vacuum at sea level; flow range of 4 cfm at 0" Hg and "0" CFM at 26" HG; 0 to 100 liter/min. (0 to 3.5 cubic feet/min) flow meter; 0 to 30" Hg vacuum gauge; 17.5" long by 7 inches wide by 10 inches high size; 30 lbs. Provide paper filter part No. FIP8, 47 mm.

2.2.6.3 Contracor shall furnish and install items identified on drawings H-2-82750.

## 2.2.7 Pressure switch:

2.2.7.1 Pressure switch (PS-1): Similar to Dwyer 1910-00, diaphragm operated to actuate SPDT snap switch, range 0.07 to 0.15 inches of water, with adjustable set point.

2.2.7.2 High Pressure switch (PS-2): Similar to Dwyer 1910-5, diaphragm operated to actuate SPDT snap switch, range 0.07 to 0.15 inches of water, with adjustable set point.

## 2.3 FABRICATION

2.3.1 Fabricate duct in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Applicable construction pressure classification is a minimum operating pressure of 6.5 inches of water positive and 6.5 inches of water negative operating pressure.

2.3.2 Seal duct seams and joints airtight. Apply 100 percent coverage of duct sealer to longitudinal seams and transverse joints before assembling.

2.3.3 Provide companion angle flanges at duct-to-equipment joints unless otherwise noted. Gasket material shall be neoprene.

2.3.4 Install turning vanes, meeting the requirements of subparagraph 2.1.7.1 in rectangular section square elbows.

2.3.5 Air Test Connections: Install permanent connections for pitot tube traverse and static pressure readings where necessary to perform testing and balancing specified in SMACNA HVAC Systems--Testing, Adjusting and Balancing Publication. Pitot tube connections shall consist of 1 inch drilled hole in duct, capped with 1 inch plugged coupling brazed in place. Where it is not possible to read static pressure with pitot tube, static pressure connections shall be installed and shall consist of 1/16 inch drilled hole in duct, capped with 1/8 inch plugged coupling brazed in place. Inner surface of duct shall be smooth and flush. Arrange the test connections as shown in SMACNA.

2.3.6 Touch up damaged zinc with zinc-rich coating.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

3.1.1 Duct: Attach hangers and supports to primary structure of building, equipment, and duct. Furnish and install secondary steel structures where required to support duct or equipment.

##### 3.1.2 Duct Insulation

3.1.2.1 Surfaces to receive insulation shall be clean, free of moisture, oil, dirt, scale, rust, and other foreign material.

3.1.2.2 Insulation and finish materials shall be dry when applied.

3.1.2.3 Score or groove insulation to fit contours of duct. Fill and seal scores, grooves, joints, and penetrations with insulating cement.

3.1.2.4 Install insulation meeting the requirements of subparagraph 2.1.8.3 on interior surfaces of duct.

3.1.2.5 Attach insulation to metal duct surfaces with adhered clips and washers and 100 percent coverage of insulation cement. Space clips at not more than 12 inches on center.

##### 3.1.3 Drain Piping

3.1.3.1 Secure pipe hangers and supports to pipe and primary structure of building.

3.1.3.2 Support vertical piping at least once each 12 feet of vertical run.

3.1.3.3 Fabricate and install in accordance with Pipe Code, UPC, the drawings, and this Section.

3.1.3.4 Keep piping systems clean during work. Once fabrication has started on length of pipe, plug or cap open ends when erection is not in progress to prevent entry of dirt and other foreign material.

3.1.3.5 Ream pipe to nominal inside diameter after cutting.

3.1.3.6 Flushing: Flush lines for at least 1 minute or until effluent is clean and contains no visible particulate matter.

#### 3.1.4 Piping Insulation

3.1.4.1 Apply uniform thickness to pipe, fittings, flanges, and valves after testing has been completed and system has been accepted by KEH Field Contract Engineer. Thickness shown on the drawings.

3.1.4.2 Materials shall be dry when applied.

3.1.4.3 Surfaces to receive insulation shall be free of moisture, oil, dirt, scale, rust, or other foreign material.

3.1.4.4 Butt preformed sections tightly. Fill broken corners of sections with insulating cement.

3.1.4.5 Insulation shall be continuous through wall, pipe sleeves, and other openings.

#### 3.1.5 Equipment

3.1.5.1 Install where shown on the drawings in accordance with manufacturer's instructions.

3.1.5.2 Install filters after construction has been completed and debris removed.

#### 3.1.6 Automatic Control Systems

##### 3.1.6.1 Instruments and wiring

a. Install instruments in accordance with manufacturer's instructions.

b. Install wiring in accordance with NFPA 70 (NEC).

c. Install low-voltage wiring in conduit. Installation of conduit is specified in Section 16400.

d. Instruments and controls located outside building shall be provided with weatherproof enclosure.

e. Control system functional verification

1) After controls have been connected, test system to demonstrate capability of automatic controls to function properly.

2) After test has been performed, submit control system functional verification report, signed and dated by Contractor, to KEH Field Contract Engineer. Report shall tabulate actions performed during test procedure and include characteristics of system observed during tests.

3.2 FIELD QUALITY CONTROL

3.2.1 Testing and Balancing HVAC Systems

3.2.1.1 After system is installed and duct cleaned, place exhaust and outside air fans in operation in accordance with manufacturer's instructions. After fans have been in operation for at least 4 hours test and balance the HVAC systems in accordance with SMACNA Testing, Adjusting and Balancing publication, and under surveillance of KEH Field Contract Engineer.

3.2.1.2 Furnish instruments, materials and labor required to perform testing and balancing of systems. Instruments shall have been calibrated by approved testing laboratory with date of calibration and date of expiration marked on them.

3.2.1.3 Do not use instruments which are part of system for testing and balancing. Check instruments of system against test instruments.

3.2.1.4 Maximum vibration, peak-to-peak displacement, of fan shaft is 2 mils.

3.2.1.5 Check calibration of controls. Recalibrate in accordance with manufacturer's instructions if required.

3.2.1.6 After balancing has been completed, check test points to obtain exact operating conditions of each component while systems are in operation.

3.2.1.7 Data to be recorded

a. Record vibration of fan shaft along with testing and balancing data for each system specified, except unit heaters.

b. After test has been performed, submit Test and Balance Data report. Test data shall be tabulated and submitted with flow sheet indicating points of measurement. Include characteristics of systems that were observed during tests. Include failure of system and control components to meet operational functions required by the drawings and this Section.

3.2.1.8 Testing and balancing sequence: Perform in accordance with sequence given by SMACNA.

3.2.2 Structural Welding: Visual examination of structural welding will be performed by KEH Acceptance Inspector in accordance with AWS D1.1, 6.5.5 and 8.15.

### 3.3 ADJUSTING AND CLEANING

#### 3.3.1 Cleaning - Duct

3.3.1.1 Provide cleaning equipment, scaffolding, materials, and labor necessary to clean ductwork.

3.3.1.2 Remove debris from inside of new duct and plenums. Then vacuum to remove small particles of rubbish and dust.

3.3.1.3 Replace duct removed for cleaning or damaged.

3.3.1.4 Install filters after debris has been removed.

PIPE CODE P-3			
Piping System:	Max Operating Pressure:	Max Operating Temperature:	Test Pressure:
Condensate Drain (D)	Atmospheric	Ambient	10 psig
Sizes	All sizes		
Pipe	Copper tubing, ASTM B 88, Type 1, hard drawn.		
Fittings	ANSI/ASME B16.29 wrought copper.		
Joints	None		
Valves	None		
Test	In accordance with UPC Section 318, Paragraph 2, water test.		



<b>KAISER ENGINEERS HANFORD</b>		<b>LEAKPRESSURE TEST CERTIFICATION</b>		Report No.	Page 1 of 1																		
Project or W.D. No.		Item		Design Reference																			
Construction Specification		Code or Standard		Test Procedure Ref.																			
		Year		Stamp Required <input type="checkbox"/> Yes <input type="checkbox"/> No																			
Description of System or Component(s) Test Boundaries																							
<b>TEST PREPARATION</b>																							
<b>Inspection Requirements</b> <input type="checkbox"/> Quality Control <input type="checkbox"/> Acceptance Inspection <input type="checkbox"/> Safety Engineer <input type="checkbox"/> Check _____ <input type="checkbox"/> Authorized Inspector <input type="checkbox"/> _____		<b>Valve Line-up Requirements (For permanent valve only)</b> <table style="width: 100%;"> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> <tr> <td>Valve L.B. _____</td> <td><input type="checkbox"/> Open</td> <td><input type="checkbox"/> Close</td> </tr> </table>				Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close	Valve L.B. _____	<input type="checkbox"/> Open	<input type="checkbox"/> Close
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Required Test Medium Medium _____		Required Test Medium Temp Temp _____		<input type="checkbox"/> Blue Chalking Required <input type="checkbox"/> Soap Solution Required																			
Design System Pressure _____		Design Test Pressure _____		Prepared By _____ Date _____ Hold Time _____																			
<b>PRETEST CHECKLIST</b>																							
Item or Requirement		Crack Supervision	Quality Control																				
			Accept	Date																			
Valve line-up per design requirements (see above line up).																							
Flushing of system and/or component completed per design requirements.																							
All lines or components not to be tested are properly isolated or disconnected.																							
Valves and openings checked; proper Pressure Relief Valve installed and discharge checked.																							
Test medium per design requirements; temperature equalized. Medium _____ Medium Temp. _____ (ASME only)																							
Test gauge(s) checked range and currently calibrated.																							
SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____ SN _____ Range _____ Cal. Due Date _____																							
Pressure Relief Valve properly set and currently calibrated.																							
SN _____ PS Set _____ Checked Date _____ SN _____ PS Set _____ Checked Date _____ SN _____ PS Set _____ Checked Date _____																							

KEN-1757-81 (2/88)

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|--------------------|--|
| ICS 2-1988         | Industrial Control Devices,<br>Controllers, and Assemblies   |
| ICS 6-1988         | Enclosures for Industrial<br>Controls and Systems  |
| KS 1-1983          | Enclosed Switches  |
| PB 1-1990          | Panelboards  |
| RN 1-1989          | Polyvinyl-Chloride Externally<br>Coated Galvanized Rigid Steel<br>Conduit and Intermediate Metal<br>Conduit  |
| ST 20-1986         | Dry-Type Transformers for<br>General Applications  |
| WD 1-1983 (R 1989) | General Requirements for Wiring<br>Devices   |
| 1.1.1.4            | National Fire Protection Association (NFPA)  |
| NFPA 70            | National Electrical Code (NEC),<br>1990 Edition  |
| 1.1.1.5            | Underwriters Laboratories, Inc (UL)  |
| 1990               | Electrical Appliance and<br>Utilization Equipment Directory  |
| 1990               | Electrical Construction<br>Materials Directory   |
| UL 797-1977        | Electrical Metallic Tubing   |
| UL 1242-1985       | Intermediate Metal Conduit   |
| 1.2                | SUBMITTALS: Refer to Section 01300 for submittal procedures.   |
| 1.2.1              | Approval Data: Submit information listed on Approval Data List<br>in this Section.   |
| 1.3                | QUALITY ASSURANCE  |
| 1.3.1              | Standards: Products shall be identified for intended purpose by<br>Underwriters Laboratories, Inc (UL) in the Electrical Appliance and<br>Utilization Equipment Directory or Electrical Construction Materials<br>Directory, and bear listing mark of laboratory. In absence of mark, submit<br>documentation of applicable listing. |

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Solderless Connectors and Terminal Lugs: Pressure type, rated for use with copper or aluminum conductors with insulating caps or covers rated for system utilization voltage. Connectors shall be types specified below.

2.1.1.1 For conductors #8 AWG and smaller:

- a. Similar to Ideal Industries, Inc "Wire-Nuts."
- b. Similar to Thomas and Betts Company "Sta-Kon."
- c. Similar to 3M Company "Scotchlok."

2.1.1.2 For conductors #6 AWG and larger:

- a. Similar to Burndy Engineering Company "Screw Pressure Connectors" or "Hydent."
- b. Similar to Thomas and Betts Company "Lock-tite."

2.1.2 Raceways, Fittings, and Boxes

2.1.2.1 Conduit shall meet the requirements of appropriate standard as follows:

- a. Rigid steel ANSI C80.1
- b. Intermediate metal UL 1242
- c. Electrical metallic tubing (EMT) UL 797
- d. PVC (Schedule 40) FS W-C-1094, Type II
- e. PVC (Schedule 80) NPMA TC2 and/or UL651
- f. Flexible metal FS WW-C-566
- g. Rigid aluminum and fittings FS WW-C-00540

2.1.2.2 PVC coating on rigid steel conduit: Factory applied, and meeting the requirements of NEMA RN 1, Type A-40.

2.1.2.3 Conduit fittings for rigid steel and electrical metallic tubing shall meet the requirements of NEMA FB 1. Only compression type threadless fittings shall be used with EMT.

2.1.2.4 Fittings used with flexible metal conduit shall meet the requirements of FS W-F-406 and be squeeze type only. Flexible metal conduit shall have integral ground conductor.

2.1.2.5 Use "Myers" type watertight fittings or sealing locknuts similar to ones manufactured by Midwest Electric Manufacturing Corp, for conduit entries into sides or tops of NEMA Type 12 or NEMA Type 3R enclosures.

2.1.2.6 Interior lighting fixture outlet boxes: Above ceiling, 4 inch octagonal pressed steel. Below ceiling, 4 inch weatherproof cast boxes.

2.1.2.7 Exterior lighting fixture outlet boxes: Cast with threaded hubs.

2.1.2.8 Exterior (Interior) receptacle outlet boxes: Cast metal type.

2.1.2.9 Telephone outlet boxes: Cast metal type for single device.

2.1.3 Conductors: Copper conductors only.

2.1.3.1 Building wire.

2.1.3.1.1 #12 or #10: Solid THWN/THHN.

2.1.3.1.2 #8 or larger: Class B Stranded THWN/THHN or XHHW.

2.1.3.1.3 #12 minimum unless otherwise noted on drawings.

2.1.3.2 Control wire.

2.1.3.2.1 Overhead door control circuits: #12 THHN/THWN Class B Stranded.

2.1.3.2.2 Other control circuits: As described on the drawings or in other Sections of the Specifications.

2.1.4 Wiremarkers: Imprinted tubular plastic.

2.1.5 Equipment Nameplates: Laminated plastic, 1/16 inch thick with white surface and black core, 7/32" letter height, 1" high x 2" wide unless otherwise indicated. Edges beveled and smooth. Engraved nomenclature sharp and clear.

2.1.6 Concrete and Masonry Anchors: Similar to Kwik-Bolt manufactured by Hilti Fastening Systems or Red Head Wedge Anchor manufactured by Phillips Drill Company.

2.1.7 Wire Pulling Compound: Similar to "Y-er Eas" manufactured by Electro Compound Company or Polywater manufactured by American Polywater Corp.

2.1.8 Tape

2.1.8.1 Plastic insulating tape: Similar to "Scotch No. 33+" manufactured by 3M Company.

2.1.8.2 Conduit protection tape: Similar to "Scotchrap No. 50" manufactured by 3M Company.

2.1.9 Insulating Putty: Similar to "Scotchfil" manufactured by 3M Company, GE No. 8389 manufactured by General Electric Co, or "Airseal" manufactured by Kearney Company.

2.1.10 Duct Sealing Compound: Similar to "Sealex" manufactured by Porcelain Products Co or "Kerite" manufactured by Kerite Co.

2.1.11 Fire Barrier Sealing Compound

2.1.11.1 Sealant: RTV silicone foam; similar to Semco PR 855 RTV, Dow Corning Type 3-6548 RTV, or General Electric Type RTV 800.

2.1.11.2 Caulking: Similar to "CP 25" Caulk manufactured by 3M.

2.1.11.3 Putty: Similar to "303 Putty" manufactured by 3M.

2.1.12 Hangers for Individual Conduits: Factory made springable wrought steel clamps or malleable iron, split and hinged rings. For suspended conduit, clamps or rings shall be bolted to, or interlocked with threaded suspension rod.

2.1.13 Sealant: See Type II, Section 07900.

## 2.2 EQUIPMENT

2.2.1 Equipment enclosures shall meet the requirements of NEMA ICS 6 and be Type 12 Indoors or Type 3R Outdoors.

2.2.2 Panelboards: Rating shown on panelboard schedule, UL labeled, and meeting the requirements of NFPA 70 (NEC), NEMA PB 1, and FS W-P-115. Flush or surface mounting as shown on panelboard schedule. NEMA 12 or 3R as indicated.

2.2.2.1 Provide with main circuit breakers, except as noted.

2.2.2.2 Provide doors with flush-type combination catch and locks, keyed alike and furnished with 2 keys for each panelboard. Provide each panelboard with directory card holder and card for branch circuit load identification.

2.2.2.3 Furnish with nameplate engraved with panelboard designation shown on panelboard schedule. Attach nameplate to front of panelboard above door in accordance with paragraph 3.2.1.2 g.

2.2.2.4 Furnish indoor panel with nameplate engraved with, "Do Not Spray Water on Equipment."

2.2.2.5 Branch circuit breakers: Molded case bolt-on type with thermal magnetic trips, meeting the requirements of FS W-C-375. Number, rating, and arrangement are shown on panelboard schedule. Permanently number branch circuits. Number tabs shall not be attached to, or be part of, circuit breaker. Each individual breaker shall have means for positive lockout in the "off" position.

a. Branch circuit breaker positions marked "space": Bussed for future circuit breakers. Provide removable single pole filler plates for spaces shown on panelboard schedule.

2.2.3 Motor Load Fuses: Meet the requirements of ANSI C97.1 and be following types.

2.2.3.1 250 volt rated: Similar to Buss, Fusetron, Catalog No. FRN.

2.2.3.2 600 volt rated: Similar to Buss, Fusetron, Catalog No. FRS.

2.2.4 General Purpose Transformers: Dry type, 60 Hertz, of KVA rating shown on the drawings with minimum two 2-1/2 percent taps above and two 2-1/2 percent taps below normal rated primary voltage. Insulation system rated 220° C with 115° C winding temperature rise above ambient. Transformers shall be floor or wall mounting as required and meet the requirements of NEMA ST 20.

2.2.5 Combination Motor Controllers: Horsepower rated, with 2 NO and 2 NC auxiliary contacts. Bimetallic or melting alloy type overload elements are acceptable. Overload relay reset in cover. Circuit breakers shall meet the requirements of FS W-C-375 and be instantaneous motor circuit protector type. Controllers shall meet the requirements of NEMA ICS 2-321.

2.2.6 Manual Motor Controllers: Toggle-operated, provided with means for locking in "Off" position, and nameplate engraved in accordance with the drawings. Controllers shall meet the requirements of NEMA ICS 2-328.

2.2.7 Safety Switches: NEMA 12 or 3R for inside or outside respectively. Shall meet the requirements of NEMA KS 1; fusible or nonfusible type HD, horsepower rated for 600V or 250V ac or dc as noted on the drawings. Fuses shall be cartridge type, dual element, UL Class K5, and meet the requirements of ANSI C97.1.

2.2.8 Terminal Blocks

2.2.8.1 For #10 AWG conductors and smaller: Either 1 piece or factory assembled sectional double terminal, barrier type, with binder screw terminals. Terminal ampacities shall be equal to or greater than conductor ampacities; similar to Buchanan #711 or #B112.

2.2.8.2 For #8 AWG conductors and larger: Either 1 piece or factory assembled sectional barrier type with box lug terminals having pressure plate between screw and conductor. Size terminals to accommodate conductors to be connected. Similar to Buchanan #427.

2.2.8.3 Furnish covers to cover live parts of terminations for circuits of more than 150 volts to ground. Provide with means for ready inspection and full width marking areas.

2.2.9 Lighting Fixtures: Furnish with parts and fittings necessary to install in accordance with manufacturer's instructions.

2.2.9.1 Fixtures of each type described shall be of 1 manufacturer and identical finish and appearance.

## 2.2.16 Indicating lights

2.2.16.1 Indicating light shall be full voltage type 120 VAC with incandescent lamp and legend plate. Similar to Allen Bradley Bull 800 H-QR10R with #N169 lamp.

2.2.16.2 Caps shall be colored as follows general:

Safe or Normal	Green
Caution Condition	Amber
Danger or Abnormal Condition	Red
Motor Control Centers	
- Motor stopped, power on	Green
- Motor running	Red
Motorized or solenoid valves	
- Closed position	Green
- Open position	Red

2.2.17 Contactors: Mechanically held in both open and closed positions. Similar to Automatic Switch Company #917 Series.

2.2.17.1 Coil operating voltage: 120 volts ac.

2.2.17.2 Contacts: 20 AMP, 600 volts, 60 HZ, 2 to 8 contacts as indicated on drawings; single throw, double break configuration. Rated 22 K AIC symmetrical at 250 volts ac.

2.2.17.3 Auxiliary contact: Shall have one N.O. and one N.C. contacts.

2.2.17.4 Terminals: Solderless clamp type screw terminals for wire size #18 through #10.

2.2.18 Timing Relays: Solid-state mechanisms with time ranges as shown on drawings. 20A min. contacts, 120V 60Hz coil rating.

## PART 3 - EXECUTION

### 3.1 PREPARATION

3.1.1 Field Measurements: Scaled dimensions on drawings show desired and approximate location of equipment. Actual locations, distances, and levels shall be governed by field conditions.

### 3.2 INSTALLATION

#### 3.2.1 General

3.2.1.1 Perform work in accordance with the NEC.

3.2.1.2 Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

a. Use clamping devices for attaching to structural steel, or, when clamping is impracticable, obtain written authority from KEH Field Contract Engineer to weld to, drill or cut structural members to provide attachment.

b. Fasten equipment to concrete or masonry with expansion anchors.

c. Attach to drywall by screws into studs, and to metal wall panels by weld studs, bolts, or self-tapping metal screws.

d. Locate equipment, boxes, and conduit approximately where shown in relation to equipment served.

e. Do not install conduit raceways and boxes in positions that interfere with work of other trades.

f. Identify components by nameplate engraved with designation and function shown on the drawings.

g. Attach nameplates, on or near equipment, with clear RTV silicone sealant.

3.2.1.3 Use appropriate special tools when installing devices for which special installation tools are recommended by manufacturer.

3.2.2 Grounding Systems: Reference NEC Section 250.

3.2.2.1 Underground conductors, electrodes, and connections: Install in accordance with the drawings. Make joints connecting copper and galvanized steel conductors above grade and in dry location.

3.2.2.2 System and equipment grounding: Solidly ground neutral conductor of 3 wire, 1 phase and 4 wire, 3 phase, wye-connected distribution systems. Ground equipment in accordance with the drawings and NEC Section 250.

3.2.3 Conduit

3.2.3.1 Use rigid steel or intermediate metal where subject to mechanical damage, installed in concrete floors and walls, installed exposed to weather, or installed 4 feet or less above floor. Electrical metallic tubing may be used elsewhere, when connecting electrical equipment 2 feet or less apart, and when entering top of electrical equipment 4 feet minimum above floor.

3.2.3.2 Install #14 gage galvanized steel pull wire or 1/8 inch polyethylene rope in spare conduits.

3.2.3.3 Install concealed conduits as directly as possible and with bend radii as long as possible. Install exposed conduit parallel with or at right angles to building lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at minimum height of 9 feet above floor level or grade.



3.2.3.4 Permanently label each conduit, using black paint and stencil, at both ends, with number shown on the drawings.

3.2.3.5 Make elbows, offsets, and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.3.6 Cut square, ream, and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are installed. Paint exposed ends and threads with Galvinox or approved equal to prevent rusting.

3.2.3.7 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing type locknuts shall be used outdoors or where moisture is present. Threadless fittings will not be permitted for rigid conduit. Use Erickson type couplings where required. Do not use running threads.

3.2.3.8 Use 1 hole clamps equipped with clampbacks or Unistrut with clamps to secure conduits.

3.2.3.9 Install without moisture traps wherever possible. Where practicable, provide drain holes in pullboxes or fittings at low points in raceway systems and remove burrs from drilled holes.

3.2.3.10 Flexible conduit

a. Use to make connections to motors, instrumentation and other equipment subject to vibration. Use liquidtight, flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors.

b. Use in lengths not exceeding 4 feet for other equipment, with approval of Field Contract Engineer.

c. Use for flush and recessed lighting fixtures in lengths at least 4 feet, but not exceeding 6 feet.

3.2.3.11 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.3.12 Install exposed conduit stubbing up through floor slab straight and plumb, lined up, and uniformly spaced. Install at sufficient depth below slab to eliminate part of bend above top of slab. Cap or plug stub-up before placing concrete. Verify stub-up locations with final equipment arrangements.

3.2.3.13 Wrap conduit passing from concrete to air or to direct earth burial with conduit protection tape from 3 inches in concrete to at least 12 inches in earth, or 3 inches in air, unless conduit is PVC coated.

3.2.3.14 Seal opening around conduit at concrete or block fire walls and floor penetrations for openings 1/4 inch and less using fire barrier sealing compound and for openings greater than 1/4 inch with grout. Make seal water-proof and finish sealant flush with surrounding surface.

3.2.3.15 Seal opening around conduit at exterior wall penetrations and penetrations of walls which form boundaries between adjoining ventilation zones, using specified sealant. Make seal waterproof and finish sealant flush with surrounding wall surface.

3.2.3.16 Use hangers with 3/8 inch rods for 2 inch conduit and smaller and hangers with 1/2 inch rods for 2-1/2 inch conduit. If conduit is suspended on rods more than 2 feet long, rigidly brace to prevent horizontal motion or swaying.

3.2.3.17 Apply duct sealing compound after installation of conductors, at boxes, in conduits that penetrate walls or floors.

3.2.3.18 Where routing is parallel with hot water or steam pipes, maintain minimum 6 inch clearance from pipe covering. Where not run parallel with pipe it is acceptable to run closer than 6 inches, providing conduit does not touch pipe covering.

3.2.3.19 Encase conduit installed below on-grade floor slab with minimum 3 inches of concrete on all sides or use PVC coated rigid steel.

3.2.3.20 Install PVC coated conduit in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

3.2.4 Metal Raceway Other Than Conduit: Install complete with necessary fittings, connectors and parts, in accordance with recommendations of manufacturer.

3.2.5 Underground Duct Banks

3.2.5.1 Use either rigid steel or PVC conduit in concrete encased duct banks.

3.2.5.2 For single conduit runs, PVC coated rigid steel conduit may be used instead of concrete encased duct bank.

3.2.5.3 Install underground ducts in accordance with the drawings and route without drains where possible.

3.2.5.4 Boxes shall be cast, NEMA 12 or NEMA 3R, depending on size and location.

3.2.5.5 Where drains or risers are required, install in accordance with the drawings. Seal conduit at both ends with duct sealing compound.

3.2.5 Boxes, Enclosures, and Wiring Devices

3.2.5.1 Install boxes firmly in position and plumb.

3.2.5.2 Install extension ring with blank cover on flush mounted junction boxes where box serves permanently installed equipment.

3.2.5.3 Flush mount junction boxes served by concealed conduit.

3.2.6.6 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15° F or below.

3.2.6.7 Install and mark direct burial cable in accordance with the drawings.

### 3.2.7 Splices, Taps, and Cable Terminations

3.2.7.1 Make splices and taps in building wire with solderless connectors described in Paragraph 2.1.1. Use connectors in accordance with manufacturer's instructions.

3.2.7.2 Use plastic insulating tape for uninsulated splices and taps. Apply tape to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.

3.2.7.3 Use crimp-on type ring or spade lugs with turned up legs for wire terminations of stranded conductors to binder screw or stud type terminals. Lugs shall have insulated sleeves.

### 3.2.8 Lighting Fixtures

3.2.8.1 Mount suspended lighting fixtures as shown on the drawings. Use fixture stud if lighting fixture is suspended from outlet box. Only keyless fittings may use box cover fastening screws for support.

3.2.8.2 Where surface or above-ceiling fixtures are mounted on, or lay above suspended "tee" ceiling, support fixtures as follows.

a. By hanger wires fastened to building structure. Provide and install hanger wires necessary. Support fixtures 8 feet in length or continuous rows on 4 foot centers along length with minimum #9 gage galvanized hanger wires. Where fixture spacing of surface-mounted fixtures place edges in coincidence with "tees", use specially approved scissor type devices, which cannot be accidentally removed from "tee" when properly installed, to attach fixtures to "tees". Where fixture edges do not coincide with "tees", install 1-1/2 inch channel, Unistrut or Kindorf channel, with welded or bolted studs, bridging main ceiling "tees".

b. Framing members of suspended ceiling systems may be used to support fixtures where fastened to each other and attached to building structure at appropriate intervals. Fasten fixtures to ceiling framing member by bolts, screws, rivets, or clips identified for use with type of ceiling framing member and fixture.

### 3.2.9 Motor Control Centers

3.2.9.1 Install in accordance with equipment manufacturer's instructions and this Section.

3.2.9.2 Anchor both front and back to concrete curb with 2 anchors minimum placed in each vertical section. Assemble control centers and connect wiring at shipping section breaks. Check and tighten connections.

Replace covers and enclosures removed for shipment or installation and bolt into place.

3.2.9.3 Check bus phasing before making cable connections. Connect cable and bus conductors with phase sequence as follows when observed from front.

A Phase - Front	Left	Top
B Phase - Center	Center	Center
C Phase - Rear	Right	Bottom

3.2.10 Motor - Operated Equipment: Connect cranes, air compressors, fans, pumps, valves, etc in accordance with the drawings, this Section and manufacturer's instructions. Install wiring to devices which do not appear on the drawings, but are included in installation shown on the manufacturer's drawings.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Testing, General

3.3.1.1 Test equipment and wiring for continuity and unintentional grounds and verify proper phase sequence and voltage at equipment served before attempt is made to operate equipment. Notify KEH Acceptance Inspector before start of tests. Correct items found, during testing or examination by KEH Acceptance Inspector, to be at variance with the drawings and this Section.

3.3.1.2 Furnish instruments, labor and equipment required to conduct testing.

3.3.1.3 Use test instruments which bear valid calibration stamp showing date of calibration and expiration date of stamp. Calibration and accuracy of test instruments shall be certified by independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

3.3.1.4 In addition to testing specified to be performed by Contractor, installation will be subject to examination by KEH Acceptance Inspector for conformance with design and applicable codes. Assist the KEH Acceptance Inspector as requested.

#### 3.3.2 Motors

3.3.2.1 Measure and record voltage, current, and verify value agrees with data on nameplate.

#### 3.3.3 Wiring Systems

3.3.3.1 Megger conductors rated 600 volts and used for services, feeders or branch circuits over 150 volts to ground, phase-to-phase, and phase-to-ground. Minimum acceptable value of insulation resistance is 200 megohms. Megger manufacturer's instruction pamphlet, furnished with

megger, shall provide instructions for conducting tests. Disconnect devices not capable of withstanding voltage or current of megger test, such as indicating instruments, relays and lamps, before test is made. Voltage output of megger shall be 1000 V dc, nominal.

3.3.3.2 Test wiring operating less than 150 volts to ground for continuity and unintentional grounds. Resistance shall not exceed 1 ohm on continuity checks, except for #18 and smaller conductors.

3.3.3.3 Contractor may elect to group and connect together conductors within raceway while performing megger test. Record readings which indicate less than minimum acceptable value. Repeat megger test after replacement of defective wiring.

3.3.3.4 Reconnect devices disconnected during testing.

[illegible]

## SECTION 16720

### ALARM AND DETECTION SYSTEMS

#### PART 1 - GENERAL

##### 1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

##### 1.1.1.1 American National Standards Institute (ANSI)

ANSI C80.1-1983	Rigid Steel Conduit--Zinc Coated
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##### 1.1.1.2 Factory Mutual System (FM)

1991 Edition	Approval Guide
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##### 1.1.1.3 Federal Specifications (FS)

W-F-406D	Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible
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TT-S-00230C, Including AMD 2	Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, And Glazing In Buildings And Other Structures)
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WW-C-566C	Conduit, Metal, Flexible
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##### 1.1.1.4 Federal Standards (FED STD)

FED-STD-595B	Colors Used in Government Procurement
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##### 1.1.1.5 National Electrical Manufacturers Association (NEMA)

FB 1-1988	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
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FU 1-1986	Low Voltage Cartridge Fuses
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ICS 6-1988	Enclosures for Industrial Controls and Systems
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KS 1-1983	Enclosed Switches
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RN 1-1989

Polyvinyl-Chloride (PVC)  
Externally Coated Galvanized  
Rigid Steel Conduit and  
Intermediate Metal Conduit

1.1.1.6 National Fire Protection Association (NFPA)

NFPA 70

National Electrical Code (NEC),  
1990 Edition

NFPA 72

Installation, Maintenance and  
Use of Protective Signaling  
Systems, 1990 Edition

NFPA 72E

Automatic Fire Detectors,  
1990 Edition

72H

Guide for Testing Procedures  
for Local Auxiliary, Remote  
Station, and Proprietary  
Protective Signaling Systems,  
1988 Edition

NFPA 1221

Installation, Maintenance and  
Use of Public Fire Service  
Communications, 1991 Edition

1.1.1.7 Underwriters Laboratories, Inc (UL)

1991, Including  
Supplement

Electrical Appliance and  
Utilization Equipment Directory

1991, Including  
Supplement

Electrical Construction  
Materials Directory

1991, Including  
Supplement

Fire Protection Equipment  
Directory

UL 797-1977

Electrical Metallic Tubing

UL 1242-1985

Intermediate Metal Conduit

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed on Approval Data List  
in this Section.

1.2.2 Vendor Information (VI): Submit information on Vendor  
Information List in this Section.

1.2.3 Installation Drawings: Submit installation drawings of fire  
alarm system.

1.2.4 Record Drawings: Submit drawings of fire alarm system as  
installed.



1.2.5 Certificate of compliance in accordance with NFPA 72.

### 1.3 QUALITY ASSURANCE

1.3.1 Standards: Products shall be identified for intended purpose by Underwriters Laboratories, Inc (UL) in the Electrical Appliance and Utilization Equipment Directory or Electrical Construction Materials Directory, and bear listing mark of laboratory.

1.3.1.1 Use fire alarm equipment listed in UL Fire Protection Equipment Directory or FM Approval Guide bearing mark of listing organization. Components not normally part of system, and not obtainable with label for purpose used, shall be UL listed but need not be labeled.

1.3.1.2 Fire alarm system design, components, and installation shall meet the requirements of NFPA 70 (NEC), 72, 72E, and 1221.

### 1.4 PROJECT CONDITIONS

1.4.1 Power Supply: A single facility power supply will be provided as shown on drawings. Failure of the facility supply shall cause trouble signal with no interruption of fire alarm service.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

2.1.1 Solderless Connectors and Terminal Lugs: Pressure type, rated for use with copper or aluminum conductors, and used in installations not exceeding 600 volts between conductors. Connectors with insulating caps or covers shall be rated for system utilization voltage. Connectors shall be types specified below.

2.1.1.1 Ideal Industries, Inc "Wire-Nuts."

2.1.1.2 Thomas and Betts Company "Sta-Kon."

2.1.1.3 3M Company "Scotchlok."

#### 2.1.2 Raceways, Fittings and Boxes

2.1.2.1 Conduit shall meet the requirements of appropriate standard as follows.

- |                                     |             |
|-------------------------------------|-------------|
| a. Rigid steel                      | ANSI C80.1  |
| b. Intermediate metal               | UL 1242     |
| c. Electrical metallic tubing (EMT) | UL 797      |
| d. Flexible metal                   | FS WW-C-566 |

2.1.2.2 PVC coating on rigid steel conduit shall be factory applied and meet the requirements of NEMA RN 1, Type A-40.

2.1.2.3 Conduit fittings for rigid steel and electrical metallic tubing shall meet the requirements of NEMA FB 1. Only compression type threadless fittings shall be used with EMT.

2.1.2.4 Fittings used with flexible metal conduit shall meet the requirements of FS W-F-406 and be squeeze type only. Flexible metal conduit shall have integral ground conductor.

2.1.2.5 Conduit entries into sides or tops of NEMA Type 3 or NEMA Type 3R enclosures shall be made with "Myers" type watertight fittings, or sealing locknuts manufactured by Midwest Electric Manufacturing Corp.

2.1.2.6 Exterior lighting fixture outlet boxes shall be cast with threaded hubs.

2.1.3 Conductors: Stranded copper of type and AWG size specified, or shown on the Drawings.

2.1.3.1 Conductor sizes #12 AWG and smaller shall be Type THWN/THHN.

2.1.4 Wiremarkers: Imprinted tubular plastic manufactured by ECP Corporation, Cleveland, Ohio, or Floytag of Seattle, Washington.

2.1.5 Concrete and Masonry Anchors: Kwik-Bolt II manufactured by Hilti Fastening Systems or Red Head Wedge Anchor manufactured by Phillips Drill Company.

2.1.6 Tape

2.1.6.1 Plastic insulating tape: Similar to Scotch No. 33+ manufactured by 3M Company.

2.1.6.2 Conduit protection tape: Similar to Scotchrap No. 50 manufactured by 3M Company.

2.1.7 Duct Sealing Compound: Similar to "Sealex" manufactured by Porcelain Products Co or "Kerite" manufactured by Kerite Co.

2.1.8 Hangers for Individual Conduits: Factory made springable wrought steel clamps or malleable iron, split and hinged rings. For suspended conduit, clamps or rings shall be bolted to, or interlocked with threaded suspension rod.

2.1.9 Sealant: See Type II, Section 07900.

2.1.10 Insulating Putty: Similar to "Scotchfil" manufactured by 3M Company, GE No. 8389 manufactured by General Electric Co, or "Airseal" manufactured by Kearney Co.

## 2.2 EQUIPMENT

2.2.1 Fire alarm equipment enclosures shall meet the requirements of NEMA ICS 6-110 and be Type 3R, 4 and 12.

2.2.2 Fire Alarm Control Panel

2.2.2.1 "Fire Alarm Panel"; Pyrotronics CP-400 meeting the requirements of NFPA 72 for Auxiliary Protective Signaling System. Panel door shall be provided with Corbin Cat. 60 cylinder lock and key. Batteries shall be sealed lead acid/Gel cell and rated for 24 hour backup.

2.2.2.2 Provide 8 fire detection zones minimum, each with end-of-line supervision to detect open circuit or unintentional grounds, in accordance with NFPA 72. The minimum zones required for transmission to the RFAR shall be as follows:

- a. Zone 1 Alarm: Sprinkler System Flow.
- b. Zone 2 Alarm: Manual Station Circuit.
- c. Zone 3 Alarm: Duct smoke detector circuit.
- d. Zone 8 Alarm: PIV and control valves tamper switches.

2.2.2.3 Provide supplementary relay modules, Model: 405R. Provide Zone Extender module: ZNE-404/S.

2.2.2.4 Label indicating lights with their function using specified nameplates.

2.2.2.5 Supply following panel mounted equipment.

- a. AC power ON indicating light (green).
- b. System fire alarm indicating light (red).
- c. System trouble indicating light (amber).
- d. Zone alarm indicating lights (red).
- e. Zone trouble indicating light (amber).
- f. Alarm/trouble silence push button.
- g. Reset-normal push button.
- h. Lamp test push button.
- i. End-of-line supervisory devices.
- j. Trouble alarm buzzer, rated 50 db at 10 feet.
- k. Gong ringing circuit.
- l. Fire alarm activating device and circuits.
- m. Supervisory activating device and circuits.
- n. Automatic power transfer switch.

2.2.2.5 Alarm signals shall latch and require manual reset.

2.2.2.6 Control panel operation.

shall: a. On incoming fire alarm signal, fire alarm activating device

- 1) Actuate a zone RFAR transmission.
- 2) Light system fire alarm indicating lamp.
- 3) Light zone alarm light.
- 4) Light incoming signal zone indicating light on Auxiliary Annunciator Panel.
- 5) Operate building alarm gongs.
- 6) Shut down HVAC unit and light F.A. lamp on HVAC control panel.

shall: b. On incoming trouble signal, supervisory activating device

- 1) Light system trouble indicating lamp.
  - 2) Light zone trouble indicating lamp.
  - 3) Actuate a RFAR system trouble transmission.
  - 4) Sound audible alarm at panel.
- c. On incoming system supervisory device trouble signal, supervisory activating device shall do the following:

- 1) Light system trouble indicating lamp.
  - 2) Light system supervisory zone indicating lamp.
  - 3) Activate a RFAR system trouble transmission.
  - 4) Sound audible alarm at panel.
- d. Fire alarm signal shall be initiated by the following:
- 1) Operating manual pull box in system.
  - 2) Tripping smoke detector, temperature detector or other sensing device.
  - 3) Operation of sprinkler head.

e. Trouble signal shall be initiated by:

- 1) Disconnecting device or wire in system.
- 2) Loss of ac circuit.

3) Ground short not part of system design.

f. System supervisory device trouble signal shall be initiated by the following:

1) Commencement of closing PIV.

2) Commencement of closing control valve.

g. Alarm gong circuit

1) Ringing circuit shall pulse 24 V dc single stroke alarm gongs at rate of 2 strokes per second.

2.2.3 Radio Fire Alarm Reporter (RFAR): G.H. Harlow Co Model GHR02M108S, government furnished.

2.2.4 Manual Fire Alarm Stations: Provide Pyrotronics Model #MS-501 or equal.

2.2.5 Secondary Power Supply

2.2.5.1 Provide secondary battery operated, power supply with automatic cut-over and return to operate fire alarm system and trouble signals in event of failure of facility power supply. Battery shall be rated for 60 hour back up.

a. Transfer from facility power supply to secondary power supply shall cause trouble signal to be initiated. No false alarms shall occur due to loss or restoration of primary power.

2.2.5.2 Provide rechargeable batteries in accordance with NFPA 72 of heavy duty, sealed lead acid (Gel cell) type battery assembly designed for fire alarm usage. Container shall be clear, molded heat resistant plastic. Battery assembly shall be sized to operate system for minimum of 24 hours after loss of charging current at ambient temperature of plus 40 F, and be capable of alarm gongs for at least 5 minutes at end of period.

2.2.5.3 Batteries: May be housed in separate ventilated metal enclosures if necessary.

2.2.5.4 Battery charger: Compatible automatic, solid state, constant voltage device with ac voltage compensation, dc voltage regulation and current limiting. Charger shall be capable of charging batteries to 100 percent of full charge in not more than 48 hours. Charger shall be included in fire alarm control panel.

2.2.6 End-Of-Line Resistor or Diode: Sized and provided by fire alarm equipment supplier.

2.2.7 Fire Alarm Gong: Single-stroke 10 inch and 6 inch diameter bell with universal mounting plate. Gong shall operate on 24 V dc, be finished signal red, and be Pyrotronics Polarized Audible device IE, BDC 1024, 624 or equal as shown on the drawings.

## 2.2.8 Detectors

2.2.8.1 Smoke detectors: Photo electric type smoke detectors suitable for use in air duct and shall be Pyrotronics Model PEC-3 with AD-3P base and with double pole contacts and model STA-# sampling tube. Sampling tube length shall be from 4'0" AFF to height of smoke detector.

## PART 3 - EXECUTION

### 3.1 PREPARATION

3.1.1 Field Measurements: The drawings show general layout of complete system including arrangement of equipment. Verify scale dimensions since actual locations, distances, and levels shall be governed by field conditions.

### 3.2 INSTALLATION

#### 3.2.1 General

3.2.1.1 Perform work in accordance with NFPA 70 (NEC), 72, 72E, and 1221.

3.2.1.2 Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

a. Use clamping devices for attaching to structural steel, or, when clamping is impracticable, obtain written authority from KEH Field Contract Engineer to weld to, drill or cut structural members to provide attachment.

b. Fasten equipment to concrete or masonry with expansion anchors.

c. Attach to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-tapping metal screws.

d. Locate equipment, boxes and conduit approximately where shown in relation to equipment served.

e. Do not install conduit raceways and boxes in positions that interfere with work of other trades.

f. Identify components by number and function shown on the drawings.

g. Attach nameplates on or near component with clear RTV silicone sealant.

3.2.1.3 Use appropriate special tools when installing devices for which special installation tools are recommended by manufacturer.

#### 3.2.2 Conduit

3.2.2.1 Use rigid steel or intermediate metal where subject to mechanical damage, installed in concrete floors and walls, installed exposed to weather, or installed 7 feet or less above floor. Electrical metallic tubing may be used elsewhere, when connecting electrical equipment 2 feet or less apart, and when entering top of electrical equipment 5 feet minimum above floor.

3.2.2.2 Install #14 gage galvanized iron pull wire or 1/8 inch polyethylene rope in conduit installed and left empty for future use.

3.2.2.3 Install concealed conduits as directly as possible and with bend radii as long as possible. Install exposed conduit parallel with or at right angles to building lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at minimum height of 9 feet above floor level or grade.

3.2.2.4 Permanently label or mark at both ends with conduit number.

3.2.2.5 Make elbows, offsets and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.2.6 Cut square, ream and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are pulled.

3.2.2.7 Use galvanized steel lock nuts and bushings for attachment to enclosures except threaded hubs may be used where permitted by the NEC. Threadless fittings will not be permitted for rigid conduit. Use Erickson type couplings where required. Do not use running threads.

3.2.2.8 Use 1 hole clamps equipped with clampbacks to secure conduits.

3.2.2.9 Install without moisture traps wherever possible. Where practicable, provide drain holes in pullboxes or fittings at low points in systems and remove burrs from drilled holes.

3.2.2.10 Use flexible conduit to make connections to equipment subject to vibration. Use liquidtight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors. Flexible conduit may be used in lengths not exceeding 4 feet for other equipment, with approval of KEH Acceptance Inspector.

3.2.2.11 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.2.12 Seal opening around conduit at exterior wall penetrations and penetrations of walls which form boundaries between adjoining ventilation zones, using specified sealant. Make seal waterproof and finish sealant flush with surrounding wall surface.

3.2.2.13 Seal and protect stubs installed for future extensions with pipe caps. Double wrap closed end with insulating tape for last 6 inches.

3.2.2.14 Use hangers with 3/8 inch rods for 2 inch conduit and smaller. If conduit is suspended on rods more than 2 feet long, rigidly brace to prevent horizontal motion or swaying.

3.2.2.15 Apply duct sealing compound in conduit at box or enclosure nearest exterior wall penetrations on both sides of wall.

3.2.2.16 Where routing is parallel with hot water or steam pipes, keep conduit at least 6 inches from pipe covering. Where not parallel with pipe, it is acceptable to run closer than 6 inches, providing conduit does not touch pipe covering.

3.2.2.17 Install PVC coated conduit in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

### 3.2.3 Boxes, Enclosures and Wiring Devices

3.2.3.1 Install boxes firmly in position and plumb.

3.2.3.2 Install extension ring with blank cover on flush mounted junction boxes where box serves permanently installed equipment.

3.2.3.3 Flush mount junction boxes served by concealed conduit.

3.2.3.4 Install dust covers on junction, pull, and outlet boxes, and other types of wiring outlets at initial installation. Do not remove dust covers until wires are installed and permanent cover or device is placed on box or outlet.

3.2.3.5 Covers of all junction boxes and terminal boxes shall be painted red.

### 3.2.4 Conductors

3.2.4.1 Do not bend cables installed in wireways to less than manufacturer's recommended minimum bending radius. Bind single conductors installed in wireways with nylon cable ties to form feeder and control cable assemblies. Bind conductors at maximum 18 inch intervals. Lay cables in wireways in straight parallel lines, and avoid crossing.

3.2.4.2 Identify each conductor as shown on the drawings with wire markers at splice or terminal point. Attach wire marker within 2 inches of wire termination. Marker legends shall be visible without moving wire or marker.

3.2.4.3 Use following color code for fire alarm system conductors.

<u>COLOR</u>	<u>WIRING APPLICATION</u>
Red and Black	Alarm initiating device, input to fire alarm control panel such as detection, manual pull stations, etc.
Dark Blue and Light Brown	Alarm device, output from fire alarm control panel such as gongs, alarm bells, and strobes.



Blue-or different from preceeding colors	Output from the fire alarm control panel to devices other than alarms.
Yellow and Tan	Supervisory device, input to the fire alarm control panel.
Orange	Between the fire alarm control panel and radio master alarm box to indicate panel status.
Black	Incoming power (phase/line) to the fire alarm panel, radio master alarm box, or indicator light.
White	Incoming power (neutral) to the fire alarm control panel, master alarm box, or indicator light.
Green/Bare	Ground wire.
Brown	Battery wiring.

a. Use colored tape to properly code existing conductors whose color does not comply.

3.2.4.4 Permanently label or mark cable at both ends with wire run number.

3.2.4.5 Use lubricant recommended by cable manufacturer, or wire pulling compound specified, to decrease friction when pulling wire and cable through conduit.

3.2.4.6 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15° F or below.

3.2.4.7 Conduit containing fire alarm signaling conductors shall not contain power supply or any other system conductors.

### 3.2.5 Devices

3.2.5.1 Install smoke detectors, pull stations, alarm bells and other fire alarm system devices where shown on the drawings and as recommended by the manufacturer.

### 3.2.6 Splices, Taps and Cable Terminations

3.2.6.1 Make splices and taps in building wire with solderless connectors described in Paragraph 2.1.1. Use connectors in accordance with manufacturer's instructions.

3.2.6.2 Use plastic insulating tape for uninsulated splices and taps on circuits up to 600 volts. Apply tape to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.

3.2.6.3 Use crimp-on type spade lugs for wire terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for conductors.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Testing, General

3.3.1.1 Test equipment and wiring installed before attempt is made to operate equipment. Resistance, current and voltage measurements may be made as work progresses. Maintain systematic record by using schedule or chart of tests and measurements. Provide space to record readings, dates and witnesses. Notify KEH Acceptance Inspector before start of required tests. Correct items found, during testing or examination by KEH Acceptance Inspector to be at variance with the drawings and this Section. Deliver test reports to KEH Acceptance Inspector weekly as completed.

3.3.1.2 Furnish instruments, labor and equipment required to conduct testing.

3.3.1.3 Use test instruments which bear valid calibration stamp showing date of calibration and expiration date of stamp. Calibration and accuracy of test instruments shall be certified by independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

3.3.1.4 In addition to testing specified to be performed by Contractor, installation will be subject to examination by KEH Acceptance Inspector for conformance with design and applicable codes. Assist KEH Acceptance Inspector as requested.

#### 3.3.2 Fire Alarm Battery Testing

3.3.2.1 Treat battery before discharge test as follows.

a. Change battery to full charged condition in accordance with manufacturer's instructions.

3.3.2.2 Conduct battery test as follows.

a. Connect variable resistance load bank to battery to provide deep discharge at about 1 or 2 hour rate, if possible. Other discharge rates are satisfactory if variables can be recorded.

b. Record voltages and currents during period of discharge, once each half hour for first half of test is sufficient, and at 15 minute intervals thereafter.

c. Verify that measured battery capacity is at least 100% of nameplate rating using curves provided by manufacturer.

3.3.3 Acceptance Testing: A written acceptance test procedure (ATP) for testing fire alarm system components and installation shall be prepared in accordance with NFPA 72 Paragraph 104.5 and NFPA 72H. The Contractor shall be responsible for performance of the ATP, and functionality of the system and equipment in verifying operability of components and circuits. Perform the ATP in presence of the KEH Acceptance Inspector.

3.3.3.1 Acceptance Test Procedure: The ATP shall include, but not be limited to, the testing of the following fire alarm system components and

installation. Testing is required by NFPA 72E, to be performed in accordance to manufacturer's instructions.

a. Proper wiring. Test fire alarm circuits for continuity and insulation resistance.

b. Alarm sounds upon operation of each manual pull station.

c. Alarm sound upon operation of each waterflow switch.

d. Alarm sounds upon operation of each supervisory switch.

e. Alarms are transmitted and received correctly, including trouble signals.

f. Batteries supply power sufficient to operate the entire system as required in this Section.

g. Loss of AC Power Test

h. Closure of PIV and OS&Y valves.

i. Alarm sounds upon operation of smoke detector.

j. Trouble alarm sounds upon grounding of supervised circuits.

k. Trouble alarm sounds upon interruption of supervised circuits.

END OF SECTION



Speciation Section 16720

**VENDOR INFORMATION LIST**  
 ("X" Indicates Required Data)

[illegible]